BUILDING SPECIFICATIONS

LEANING

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FOR THE USE OF

ARCHITECTS, SURVEYORS, BUILDERS, &c.

COMPRISING

THE COMPLETE SPECIFICATION OF A LARGE HOUSE, WITH STABLES, CONSERVATORY, &c.

ALSO

NUMEROUS CLAUSES RELATING TO SPECIAL CLASSES OF BUILDINGS, & PRACTICAL NOTES ON ALL TRADES AND SECTIONS.

BY

JOHN LEANING, F.S.I.

AUTHOR OF "QUANTITY SURVEYING"
"THE CONDUCT OF BUILDING WORK" ETC.

WITH ONE HUNDRED AND FORTY ILLUSTRATIONS

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PREFACE.

The current books on specifications for building works are constructed on various principles. Some are mere copies of old specifications which have been used for existing buildings. They comprise descriptions of work of very various qualities, some of it obsolete. Others deal to a large extent with subjects already fully treated in the various well-known books on construction; but few, if any of them, explain the reasonable order of the items, the clauses which best serve the purposes of a building contract, or their mutual congruity. As a result of the want of knowledge of these elements, we find in the specifications of the inexperienced, descriptions of materials and workmanship for a cottage which would be appropriate to a mansion; in others, of work for a building of the best kind, which would be too common for a warehouse, or of materials which have ceased to be used.

The author has endeavoured in this volume to present in a connected form a reasonable order of the trades and items of a building specification, embodying items of work fairly consistent with each other. The general specification comprises a large proportion of the items which *every* building requires. In other sections of the book will be found examples of items which are required only in buildings for special purposes, such as Churches, Schools, Warehouses, &c., and from these sections ordinary items have been excluded. In the section on preliminary considerations the various expedients adopted by the capable architect in his specifications for the initiation of a building contract are described as far as possible.

In the general notes on the trades it has appeared reasonable to include notes and sketches of construction, fittings, &c., such as are not commonly given in the existing books on

construction, but the author has tried to avoid the practice of making a book, ostensibly dealing with specifications, a mere imperfect manual of construction; a subject which has been most admirably dealt with in a number of books which need not be mentioned here.

Sketches have also been given with the view of making clear some of the descriptions which, without them, might possibly be obscure; but no better advice can be given to the student of specifications, when his information is weak on any subject, than to read carefully the best existing books which treat of it.

Some of the sections of these notes, such as those on Electric Lighting, Heating, Engine Boilers, &c., are possibly not within the limits of an architect's specification, but they may assist him to judge of and compare the competitive offers of specialists, whose intentions as to a given piece of work often differ very widely.

JOHN LEANING.

LONDON,
December, 1900.

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BUILDING SPECIFICATIONS.

SECTION I:

PRELIMINARY CONSIDERATIONS.

Object of a Specification.—The chief object of a specification for building works is the furnishing of information which the drawings do not supply.

Alternative Methods.—There are two courses possible in the production of a set of drawings and a specification. One is to write a general description of labour and materials, leaving particular directions and explanations for the drawings, the other is to put comparatively little work in the drawings and write a voluminous specification. Much labour is often wasted by putting unnecessary work in either document.

Specification assisted by Quantities.—The suggestion has been made that a specification should be quite general, and that the dimensions from which the quantities have been prepared should be kept on the works for reference—an original idea, but unreasonable. Two documents—the drawings and the specification—are all that are required at the building, if properly prepared, and two must be better than three.

Legal Importance of a Specification.—The legal importance of the document need not be enlarged upon, nor is there any doubt that its efficiency must greatly depend upon the knowledge and ability of its author. He must clearly understand what he is writing about, or he cannot properly describe it; he should say exactly what he means, and no more.

Trade Lists.—A complete knowledge of materials and construction is a necessary qualification for the specification writer, but beyond this a familiarity with trade lists is necessary, and a collection of these, methodically arranged and carefully indexed,

will prove a useful possession, and will enable him to realize those points of difference which it is desirable to emphasize.

Sources of Information.—All necessary information about details of construction and materials is to be found in the books, a list of which is given on page 592 *et seq.*

The technical description of various manufactured articles may often be best obtained from trade lists. For instance, plumbers' brass-work and sanitary apparatus, from such trade catalogues as those of Tyler & Sons, Bolding, Farmiloe, and Doulton, all of London; of ironmongery from the catalogues of Tonks, of Birmingham, or Pryke & Palmer, London; iron joists from the published lists of Measures, Shaw, Dawnay, and Lindsay, London; of glass, Hartley or Bussell Gibbs, London. See also list of trade catalogues, page 587 *et seq.*

When the writer is unable to describe a process, of fixing for instance, he may say, "fix in the best manner to the architect's satisfaction," but this should be avoided as far as possible.

London Building Act and Local Acts.—Familiarity with the London Building Act is necessary for specifying works in London. When the work is in the country the local bylaws should be examined, and in either case any necessary clauses should be inserted, so that the work described may be in accordance with them.

Besides these a knowledge of the following will be useful: the Public Health Act; the Factory Act; the County of London Regulations under the Metropolis Local Management Acts; the County of London Regulations made under the Metropolis Water Act; Regulations of the London County Council with respect to the requirements for the protection from fire of theatres, houses, rooms, and other places of public resort within the administrative County of London; Standing Orders of the London County Council under the London Building Act, 1894; The London County Council Bylaws.

Keep Description Together.—The description of a particular kind of labour and material should be kept together wherever possible. In some cases the same description or injunction appears in several parts of the same specification; the inexperienced writer appears to think that reiteration adds strength to the document.

Unreasonable descriptions.—The description in specifications of workmanship and material of the highest class in positions which any practical builder knows to be unreasonable and

unlikely to be insisted on, leads to a general system of discounting the written requirements by the experienced estimator, who tenders accordingly, and at a much lower rate than his deluded competitors, who weakly suppose that the specification means what it says. Sometimes this kind of practice is rather the result of design than ignorance. The architect deliberately speculates on the builder's interpretation of such descriptions of very expensive labour and materials, and insists upon the work described, greatly to the builder's discomfiture. A legal document such as a specification is should stipulate for the exact kind of work wanted, and for that alone, and to this end the writer should know what he wants, and insist upon its performance.

Expressive Words.—The specification writer should not be afraid of frequently repeating a good and expressive word if he cannot find a better one.

Sketches.—It is recommended by some that the specification writer should illustrate his meaning by sketches. These are sometimes useful, but the practice is apt to degenerate into the making of puerile drawings of things which can be easily described in unmistakable language by the specification.

Alternative Materials and Methods.—A specification should, as far as possible, avoid offering the option of alternative materials or execution. It is better that the writer should decide as to what he requires, and describe it as clearly as he can. If, however, alternatives are mentioned, the architect should retain the right to decide which shall be adopted.

If this is not done the builder will probably choose the cheaper material or method, as it is generally assumed that alternatives are offered in order that he may, by using the least expensive, contract for a lower amount.

Work to be done in the Best Manner.—As a general rule it is better not to describe working processes. Some of the recent specifications of sanitary work carry such descriptions to the verge of absurdity. A condition that all shall be done in the best and most workmanlike manner will usually embrace all that is necessary.

Form of a Specification.—The form of a specification will depend to some extent upon the nature of the work. The form adopted for a large building, a small building, and a work of alteration would differ considerably.

Tabulation.—The suggestions on page 7 as to numbering of

openings, tabulation, etc., apply chiefly to specifications of large buildings. In such cases the mass of information, if not presented in an orderly and thoroughly systematic manner, is difficult to find in the necessarily long specifications; for smaller specifications such methods are not required.

Distinction between Quantities and Specification.—The confusion which exists in some minds between the specification and the quantities is the result of a misapprehension of their separate functions. Each document is produced for an independent purpose, and they cannot be combined with advantage.

The specification of the Royal Exchange, London, given in Donaldson's "Handbook of Specifications," is an example of such an experiment. Specifications of this kind are most frequently made by country architects of limited experience, who, with more extensive knowledge of various methods, would probably change their practice.

Functions of a Bill of Quantities.—A bill of quantities is a schedule of labour and materials arranged in a form convenient for the attachment of prices, and the attempt to make it anything else is sure to impair its efficiency.

Use Imperative Mood.—Specifications are most conveniently written in the imperative mood, and, if so begun, should be so continued to the end.

Use of Words in One Sense only.—Care should be taken to avoid the use of one word in more than one sense. The word "provide" is commonly used in several different senses.

Do not use such words as "proper" or "sufficient." Decide what is proper or sufficient, and describe it.

The use of the word "allow" should, as a general rule, be confined to bills of quantities.

Diffuse Specifications.—It may be taken as a general rule that the less diffuse a specification is the clearer is its meaning, but its length will depend upon the amount of information on the drawings.

Order to be always the Same.—The adoption of an unchanging order in all descriptions of similar things will preserve the writer from many mistakes and omissions. Thus, in the description of an ordinary door, the following order may be maintained throughout:—

The doors of bedrooms 1, 2, 3, and 4 shall be 2 ft. 10 in. by 6 ft. 10 in.—2 in., four panels, square framed, hung with 3½ in.

iron butts to 1½ in. double-rebated jamb linings. Fit with 6 in. mortice lock and brass furniture. Finish on both sides with 2½ in. by 1¼ in. moulded architraves.

Drawings should be Complete before the Specification is Written.—The specification is more likely to be complete if the drawings are completed (at least in pencil) before it is begun.

How Architect may assist the Writer of the Specification.—The architect will facilitate the work of the specification writer, the quantity surveyor, and all others concerned if he observes the following rules :—

The architect should carefully figure the drawings, should give carcase measurements rather than dimensions clear of finishings ; give measurements of heights of floors from the top of the timbers of one floor to the top of the timbers of the next ; should furnish plans in all cases of the drains and the roof ; should as far as possible make his drawings to a uniform scale ; describe elevations by the points of the compass ; tint the various kinds of floors with a different tint ; number the bedrooms consecutively (rooms are more conveniently described by number than position) ; avoid two sets of numbers in one building. Two sets of numbers are sometimes used with most confusing results. Sometimes rooms are designated by the letters of the alphabet ; some architects number the w.c.'s with consecutive numbers. He should put the principal dimensions on the ground plan, and repeat them as little as possible on the floors above. If, however, they are repeated, take care that they agree. Indicate the floor lines by a line of distinct colour on the elevations. Sometimes the dotting of the staircases in red on the elevations is very useful, especially where floors of the same storey are at various levels. Colour with a different tint, or etch the parts of the brickwork intended to be built in cement. Colour on the elevations will prove useful, and save trouble in the specification of facings or dressings.

Indicate Position of Gas Brackets.—Mark the positions of the gas burners on the plans thus for brackets, and × thus for pendants.

Mark Opening Lights on Elevations.—Mark the opening lights in the elevations × thus, or on the plans thus, when some casements are intended to be fixed and some to open.

Level of Surface.—Make the intention clear as to ground levels. There is often an uncertainty as to whether the line marked ground level is the original or finished surface. Such a surface

should be referred to a datum (a bench mark, if possible), and if there are several levels of the surface they and that of the ground floor level should be referred to the same datum.

Indicate Roof Trusses and Joists.—Some architects show the roof trusses by dotted lines either on the plan of roof or of top-most floor, and on the plan of each floor, in a similar way, the intended direction of the joists.

Use of Explanatory Tints.—When a building is large, with much repetition, it is sometimes the practice to reproduce the plans by lithography, and to indicate on separate sheets by a tint all the rooms which have a particular kind of finish, and a note in the specification something like the following:—"All the rooms tinted pink on Plan 20 to have dados of Keen's cement 5 feet high in all, with flush moulding, 6 in. girth as capping, and similar moulding 3 in. girth as skirting"; or, "all the rooms tinted blue on Plan No. 15 are to be finished with pitch-pine joinery." Similarly the tinting of a particular material on plans or elevations will help the descriptions.

Designation of Blocks of Building by Letters.—In large buildings, of the workhouse, asylum, or hospital type, the blocks may be designated by letters, as A, B, C, etc.

Brickwork in Cement.—Sometimes piers which are intended to be built in cement are all uniformly marked with a letter, and specified thus: "All piers marked B on the elevations (or plans) are to be built in cement." An alternative to this is to tint these parts on the plans with a distinct colour, or each part built in cement may be specifically described, or a general principle may be adopted, such as all detached piers less than 14 in. by 14 in., shall be built in cement.

Order of Clauses.—When a large quantity of similar work is distributed throughout a building it will be most convenient (especially if writing the specifications from dimensions of quantities) to begin the clause with a description of the material, and follow with particulars of its situation as they occur in the dimensions, thus: "Glaze with 21 oz. sheet glass the windows and fanlights of back elevations, the basement windows, the windows looking into lighting court, etc.

Cross References.—Write cross references where possible. Thus, in the "Carpenter," write, "The whole of the first floor to be sound boarded with $\frac{3}{4}$ in. rough deal, on stout fillets" (for pugging see "Plasterer"); and in the "Plasterer," "The whole of the

first floor to be pugged 2 in. thick with lime, sand, and chopped hay" (for sound boarding see "Carpenter").

Distinguishing Openings by Letters.—Sometimes, if a great number of doors or windows are alike, they may be distinguished by letters, as A, B, etc., on the general plans, and referred to in the specification, the various trades by their letters. Thus in "Joiner:"—

"Fit the doorways marked A on the plan with 2 in. deal, six panels, moulded both sides, doors 3 ft. by 7 ft., hung with 4 in. iron butts, to 1½ inch double rebated and narrow chamfered jamb linings. Fit with 7 in. Hobbs's machine-made fine finish mortice locks, with brass furniture. Finish on both sides with 1¼ in. by 2¼ in. moulded architrave."

Or instead of letters consecutive numbers may be used, thus:—

Distinguishing Openings by Numbers.—"Fit the window openings numbered 24, 30, 102, 103, 105, 210, with deal cased frames, of 1 in. inside and outside linings, 1¼ in. pulley stiles and ½ in. back linings, all rebated and grooved together with proper beads and parting slips, 3½ in. teak double sunk weathered and check-throated sills, and 2 in. moulded sashes, double hung with Austen's No. 8 patent best superfine quality finely plaited twine lines, equal to sample, and Gibbon's (Wolverhampton) No. 20 best quality patent pulleys with solid brass fronts and wheels, steel axles, and gun-metal bushes and sides, net price, 36*s.* per dozen (gross price, 42*s.*), and iron weights. Finish with 1 in. linings, 1¼ in. rebated and rounded window boards, and 3 in. by 1½ in. moulded architraves."

Distinguishing Flues by Numbers.—Some architects number all their flues consecutively if they wish to indicate their course through the various floors. In such a case the same number, as 1, 2, 3, etc., will be repeated on each floor, and the ventilating flues indicated by the letter V. (See fig. 1.)

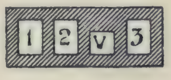

FIG. 1.

Specification may be Shortened if Details are Drawn.—When only general drawings have been produced at the specification-writing stage, and the building is ornate, a much more voluminous specification will be necessary than if the details are ready. When details are ready they are most reasonably referred to, and only their obscure or doubtful parts specifically mentioned.

Thus:—"Construct the turret over the library to detail drawing No. 28. The exposed parts to be of teak, and wrought. The parts covered with lead to be of fir or deal."

Number the Clauses of Specification.—When the work is a large one an index will be useful, and for this purpose the clauses should be numbered consecutively 1, 2, 3, etc. Only one series of numbers should be used in the same specification.

Allot a separate clause to each particular item of the work.

It will sometimes be necessary after the clauses are numbered to introduce others; these may be numbered like the clause preceding, with the addition of a letter, as 4 *a*.

Specifications of Separate Buildings.—Sometimes it will be most convenient to write an entirely separate specification in all trades of a particular part of a set of buildings, as for a conservatory, a stable, or extensive boundary walls. This may conveniently follow the specification of the main building, and in order to save repetition each subordinate section may commence with a clause: "All general items, materials, and descriptions of labour to be as described for the main building (see general specification)." The following part may then be written with many items omitted altogether, the *special* items only, for the particular section, being described in detail.

Division of the Work in a very Large Building.—A similar expedient is sometimes adopted when a large collection of buildings, like a hospital or asylum, is divided into several contracts, and possibly let to different contractors. A general specification is written, describing without localizing the whole of the items in the building, which apply throughout the establishment.

Items which only occur in a particular block are left for description in the specification of that block. It is convenient to attach to the *general* specification a complete block plan of the establishment, and to each of the subordinate specifications a similar block plan with the parts of the building involved in that contract, distinguished by a tint. In accordance with this scheme each contractor is furnished with a copy both of the general specification and a subordinate one.

Illustration of Division of a Large Work.—The large fever hospitals and similar establishments recently built in the London suburbs may illustrate the practice. The importance of speed in the preparation for contracts for these buildings and

their large size has necessitated the division of the work of preparing the quantities of each establishment among several firms of quantity surveyors. The work has been allotted in as nearly as possible equal portions, each comprising only work of similar character. As there may be, however carefully the division is made, some sections preferable to others, it is most convenient for the quantity surveyors to ballot for the sections.

In the case of division of the work among several surveyors means should be adopted to ensure uniformity of practice, so that the work may be presented in the bills in a similar way.

As the rapid erection of the buildings is even more important than the preparation of the documents, they are sometimes divided into several contracts. This extends the area of competition, and consequently keeps down the price, as it is obvious that the firms capable of dealing with a contract of two hundred thousand pounds are comparatively few.

There is, however, with this corrective, no good reason why a particular firm may not tender for several of the sections or the whole of them.

There are the same reasons for grouping work of a similar character in the sections of the contract as in the case of the quantity surveyor, although it may be advisable to depart from the principle to some extent for the sake of confining each contractor's work to a particular part of the site.

There is, however, no doubt that if the best results are desired they are best secured by the employment, for the whole work, of one quantity surveyor and one building contractor.

The fever hospital recently built at Tooting by Mr. A. Hassell Tiltman, a drawing of which he kindly permits the writer to use (see Fig. 2), may illustrate the treatment of specification before referred to.

The order of the specification was as follows:—

1. Conditions and general regulations.

2. *General* specification of materials and workmanship, avoiding all local directions.

3. Detailed specifications of the several buildings, avoiding as much as possible everything specified in section 2, and grouping those buildings which are of similar construction and finish.

The detailed specifications were as follows:—

1. Eight Scarlet Fever Wards, marked A.
2. Four Diphtheria Blocks, marked B.
3. Two Isolation Blocks, marked C.
4. Two Isolation Blocks, marked D.
5. Two Reception Blocks, marked E.
6. Two Coal Houses.
7. Discharge Block and Friends' Waiting Block, marked F.
8. Two Isolation Blocks, marked G.
9. Administrative Block, marked I.
10. Laundry and Boiler House Block, marked J.
11. Nurses' Mess Block, marked K.
12. Nurses' Homes (five blocks), marked N, O, P, Q, R.
13. Female Domestics' Cubicles (two blocks), marked S and T.
14. Medical Superintendent's House, marked U.
15. Porter's Lodge, marked W.
16. Workshop and Coffin Store, marked X.
17. Drainage, Covered Ways, Airing Courts, and Roadways.

Attached to each detailed specification was a block plan of the whole establishment, the part specified being distinguished by a tint.

The intimate connection in the initiation of a contract between the preparations of the quantities and the writing of the specification may, perhaps, excuse the statement of the allotment of the surveyor's work in this case.

Surveyor 1.

Extracts from Conditions and Preliminary items.
Six Isolation Blocks C, D, G.
Administration Block, I.
Laundry Block, J.
Nurses' Mess Block, K.

Surveyor 2.

Four Scarlet Fever Wards, A.
1, 2, 3, 4.
Five Nurses' Homes, N, O, P, Q, R.

Surveyor 3.

Four Scarlet Fever Wards, 5, 6, 7, 8, A.
Two Reception Blocks, E.
Two Domestic Cubicles, S and T.

Workshops, X.
Mortuary.
Coals.
Drains, Levelling Grounds, Roads and Paths.
Tar and Gravel Paving and Fences.

Surveyor 4.
Four Diphtheria Blocks, B.
Discharge Block and Friends' Waiting Room, F.
Steward's House, L.
Male Staff Mess, M.
Superintendent's House, U.
Porter's Lodge, W.
Covered Ways and Subways.

Two blocks of building are shown on the illustration which were not in the original contract, and are consequently not in the foregoing list.

Stereotyped Specification.—Some public bodies, like the School Board for London, whose general methods of construction are constant, and whose buildings repeat many of their arrangements, adopt a printed specification, a copy of which is sent to the quantity surveyor with the drawings, who corrects it in those clauses only where the descriptions require alteration and interpolates further descriptions, such as the particular building may demand.

Copies of Specification.—When more than three copies of a specification are required they should be lithographed or typewritten. One copy of lithographed and every copy of typewritten should be carefully examined.

Who produce the best Specifications.—Probably the best specifications are produced by the man who takes out the quantities, be he architect or surveyor. It has been the custom of late years with many architects to depute the writing of the specification to the quantity surveyor, but in either case the architect should make notes during the progress of the drawings for embodiment in the specification.

If the surveyor writes it he does so from the dimensions used to produce the quantities which these notes have assisted him to prepare.

Specification written by a Quantity Surveyor.—The practice of leaving the production of the specification in the hands of the

quantity surveyor has elicited much virtuous, but irrational, indignation from those who maintain that the architect should write all his own specifications. In many cases the extent of the architect's practice renders this exceedingly inconvenient and often impracticable, whereas the production of the notes before mentioned serves every purpose. Moreover, a quantity surveyor used to the practice of a particular architect is very soon acquainted with his methods of building, and it may easily be that the architect is more profitably engaged than in writing time after time the stereotyped clauses which are common to all specifications.

Evenness of Description—Mr. Thomas Rickman calls attention to the importance of evenness in descriptions in specifications. "If one part is much elaborated, all should be worked up to a similar pitch, otherwise the absence of detail will be taken advantage of in one trade, or the exclusion of one item assumed from the mention of another. There is great temptation to the writer of a specification to put in all he knows on one subject, while he may be led to slur over another from want of equable knowledge. The apportionment of suitable detail is an art pertaining to the profession."

Degree of Detail.—There is a danger of occasionally breaking out into *ultra* detail which may ill accord with the want of detail in other parts of the document, and when the occasional misuse of a term may throw discredit on the whole.

Quantity Surveyor's Phrases.—The phraseology and methods of description adopted by the quantity surveyor are often out of place in a specification. The use of the word "allow," "part fill and ram," etc., are familiar instances. With such as these the specification writer has nothing to do.

Process of writing a Specification.—The ordinary process of writing a specification conveniently demands a table sufficiently large to allow of the sheets for each trade being laid separately. They can then be readily taken up, items written on the sheets, and returned to their allotted place without mixture of the trades. It is advisable to divide the paper into half-sheets, and to write on one side only. Let the first page have a heading somewhat like the following:—

Heading.—Specification of works to be done in *building a house and its appurtenances* in the Warren Road, Guildford, for James Smith, Esq. (in some specifications here follows: 'according to

the drawing numbered 1 to 10 and such other drawings as may be supplied ').

GEORGE THOMPSON.
Architect,
February, 1898. High Street, Guildford.

List of Drawings.—Sometimes a list of drawings follows here. Thus :—

List of Drawings—
No. 1, Block plan.
,, 2, Basement.
,, 3, Ground Floor.
&c.

General Order.—The preliminary section should follow this, and afterwards the heading and general clauses of each particular trade, a separate sheet being commenced for each trade. These general clauses, forming in each case a kind of preamble to the trade, will spare their repetition in the description of each part of the work in such trade.

General Principles of Preambles to Trades.—As an illustration of this, if in the joiner's preamble there be a clause "all iron butts to be wrought," "all window frames to be grooved all round to receive finishings," "all floors to have glued and mitred borders to hearths," etc., such directions may be omitted from the description of the specific item to which they apply. The classification in separate sections of all the various items made of a particular wood, as oak, teak, mahogany, etc., also saves repetition of description.

Writing Specifications from Surveyor's Dimensions.—After preparing the preamble of each trade the remainder will be written by examinations of the drawing, assisted, when they exist, by the architect's notes. If written from the quantity surveyor's dimensions the writer should begin at the first column, and, proceeding regularly in order, mark the dimensions through with a vertical line in pencil as he describes each item in its respective trade. He will not attempt to finish one trade at a time, but carry all of them on simultaneously as the items present themselves in the dimensions.

When quantities have been prepared the preambles of the trades in the bill of quantities should be examined and adapted in the headings of the trades in specifications.

Abstracts and Bills of Quantities should be Consulted.—Reference to the abstracts will also be helpful: they will show at once the extent and variety of the work, and facilitate the setting out of the draft.

The bill of quantities should also be consulted, as the surveyor may have altered it at his final examination.

Order of Clauses of Descriptions.—In writing a specification from dimensions plenty of paper should be used, and ample spaces left for the insertion of clauses, as it need hardly be said that the order of the items in a set of dimensions is not the order of their arrangement in a specification.

It is advisable to begin with descriptions of things at the bottom of the building and work upwards, or at the top, and work downwards, and to maintain the same order, as far as possible, throughout the trades. When a doubt arises as to the order of the parts of a description, that in which the work would be done by the workman should be adopted.

When a specification has been written from dimensions, and they appear to have been marked through, they should be finally examined to see that every item is thus marked.

Separation of Items.—The rigid separation of the different items of a piece of work, so as to distribute them through the several trades, is probably a survival of the practice of letting the work of each trade to a separate mechanic. That system having been discontinued to a great extent in most of the larger towns, the reason for separating is materially weakened, and it will sometimes be convenient to describe items of work—such as fireplaces, ventilation, drains, etc.—complete in all trades; but the practice of describing items in the trades to which they belong has been almost universal for a great while, and persons familiar with building so naturally turn to the part of the specification which describes the particular trade, that it appears, on the whole, inexpedient to attempt the change of an almost universal practice.

Prescription of Special Manufacturers.—Before a special manufacturer is prescribed for a particular part of the work, prices should be obtained from several of equal standing, and a selection made. Where only one is available, his price may still be procured with advantage. This course may be taken with constructive iron work, terra-cotta, stone from a particular quarry, granite, etc. The price thus obtained may then be

compared with that stated to the contractors. The knowledge of the manufacturer or quarryman that his name is specified sometimes induces him to raise his price for the occasion.

It is, however, as a rule, better to avoid giving names, as it exposes the architect to unworthy suspicions, and often increases the cost of the work. Some things for which certain persons have obtained a reputation can be obtained of as good quality at a lower rate elsewhere. A careful description of quality is generally to be preferred to a name; it nevertheless sometimes happens that it cannot be avoided, and in such cases it is most convenient to state in the specification the address as well as the name of the manufacturer, thus: "Fit the lights marked thus X on elevations with Burt and Pott's (York Street, Westminster) wrought-iron casements, section 3, quality 1, accurately fitted and screwed to the frames with $1\frac{1}{4}$ in. stout copper screws, and bedded in white lead." In all such cases adopt the manufacturer's description as far as possible.

Separate Contracts.—A separate contract for a part of the work—as for tar-paving, slag concrete, granolithic work, terra-cotta, granite, faïence, ironwork (constructive or ornamental), gasfitting, bells, etc.—involves the necessity of a separate specification for such works, the more especially if the advantage of competitive prices is desired. If the architect clearly shows his desires by a specification, he puts the persons tendering in the same position, defines the point where the specialist's work begins and ends, and takes the precaution of binding him by penalty to complete in a convenient time relative to that of the general contract. Such a subordinate specification should also form a part of the general specification, so that the general contractor may judge of the apportionment of the work. If a contractor is employed for each trade, it is obvious that each one must be bound by similar conditions, and that special care must be taken in allotting the work to the several trades. The amount of a separate contract may be either included in the specification as a provision or paid direct by the building owner.

Quality of Materials and the Degree of Finish of Workmanship.—There are some useful expedients which may help the architect to ensure goodness of material and workmanship, or to make his intentions clear. One, in reference to an existing building, as:—

"The facing shall be cleft-faced square-jointed rubble, raked out and pointed at completion with a neatly struck bevelled

joint in cement, all equal and similar to that of St. Mary's Church, about a mile from the site.

"The mahogany and pitch pine to be equal in all respects to the samples to be seen in the architect's office.

"The stocks for walling, the stocks for facing, the red facing bricks, and the blue Staffordshire bricks, shall be equal in all respects to the samples to be seen in the architect's office."

Other methods may be found in the preambles to the various trades.

Supply of Material by Building Owner.—The employer anxious to save intermediate profits as far as possible sometimes supplies such things as ironmongery, sanitary apparatus, etc. The knowledge of this mistaken policy is often used by the contractor as an argument for delay. The saving is usually small, as the building owner has rarely sufficient knowledge of values to enable him to buy as advantageously as a contractor does. Often in his ignorance he buys articles of the poorest quality. Moreover, the contractor is much more likely to cut his prices closely when the whole work is in his hands than when he knows the building owner is alert to seize advantages of this nature.

Separate Contracts should be based on a Bill of Quantities.—A separate estimate for terra-cotta, quarry-worked stone (freestone granite), ironwork, etc., is best made on the basis of a bill of quantities. Variations are thus much more conveniently adjusted than in any other way.

It may be arranged so that one person may supply and the general contractor fix, or the sub-contractor may supply and fix and the general contractor supply attendance.

Materials obtained on Building Owner's Ground.—It will be necessary to describe materials if they are obtained from any source on the building owner's estate. The following instances, of common occurrence, may illustrate the method.

Burnt Clay.—The clay for burning into ballast for the paths may be dug in the field, known as the pightle, and adjoining the house, and the building owner will make no charge for it. The turf and surface soil shall be wheeled and deposited where directed, and after the clay is burned and removed the bottom of the excavation shall be levelled, the sides sloped to a batter of one in six, the soil equally spread and levelled over the whole surface, and the turf neatly relaid.

The contractor shall supply coals and labour, and thoroughly

burn the clay to a hardness satisfactory to the architect, wheel it on to the roads and paths, and level it.

Stone for Walling.—The contractor may quarry the stone for walling and for concrete without charge by the building owner at the plantation quarry, or white quarry hill, either of them about a quarter of a mile from the proposed building, and he shall deposit the rubbish so as not to interfere with the future working of the quarry.

Gravel and Sand.—The contractor may dig for gravel and sand at the pit adjoining the home farm without charge by the building owner; he shall not take any more than is required for the purposes of the building, and any earth which may arise from the baring of any part of the surface shall be wheeled, deposited and spread within two runs, and where directed by the estate steward.

Alternative Estimates.—If alternative prices are required a clause should follow immediately after the conditions of contract.

"The contractor is to state separately in his tender the difference in price if Portland stone be substituted for Bath; also the difference in price if zinc be substituted for lead to roofs, flats, gutters," etc.

These alternatives will only occur in the specifications of buildings where no quantities are supplied, as it is obviously more convenient to select the particular way of doing the work and describe that only in the specification; but whether quantities are supplied or not, a form of tender is the most convenient way of showing clearly how these differences are to be stated.

Specification of Repairs.—As before remarked, it is not, as a general rule, reasonable to combine quantities and specification. There is, however, a kind of specification participating of the nature of a bill of quantities, which may sometimes be useful—*e.g.*, when the quantity of work to be ultimately done is uncertain, and it is desirable to know what each item will amount to, such a specification is occasionally used for a work of small alteration and repair, and is drawn in some such order as follows:—

1. Conditions of contract.
2. Preliminary items.
3. Provisional sums.
4. General description of materials and workmanship only, trade by trade in the usual order.
5. Specific items.

These specific directions may be written room by room or floor by floor, and the external and internal work may form separate sections. The general form will be regulated by the extent of detail which the architect desires to obtain, and will resemble in many respects a schedule of dilapidations.

The utility of this arrangement depends upon a stipulation that a copy of the detailed estimate shall be delivered with the ender.

It is convenient to write such a specification on surveyor's bill paper. The builder will attach a price to each item, and add it up at the end, the sum total being the amount of his tender. A page of such a document would be somewhat like the following:—

	£	s.	d.
Sweep all flues, examine, repair, and make good where defective	1	0	0
Repair all defective backs of stoves and defective brickwork, and pointing to same. Repair defective plaster and floor-boarding throughout. Repair defective hearths. Cut out defective putties, and reputty with white lead and oil putty, and reinstate all defective glass. Repair and reinstate where defective beads, window-linings, sashes and frames, sash fasteners, cords, and pulleys. Examine and put in order all gas and water service pipes and fittings .	18	10	0
Rake out and repoint in lime mortar the back walls of house, repair all defective brickwork, and repair one arch and cracked portion around same . . .	11	5	0
Rub down, stop, and repair where necessary all cement reveals, and paint in three oils. Rub down, stop, and repair where necessary all window-sills, and paint in three oils	4	15	0
Continued . . . £			

Specifications of Repairs, Alterations and Additions.—In the construction of a specification for works of alterations and additions it is often more convenient to *group* the work and describe each *section* of the alteration separately in all trades, than to adopt the usual method of describing the whole of the work in the building together and separating it into trades, in which case the task of finding the items referring to a particular part of the building is tedious and uncertain.

The order suggested is as follows :—

1. Conditions of contract.
2. Preliminary items.
3. Provisional sums.
4. General description of *materials and workmanship only*, trade by trade in the usual order.
5. Specific descriptions of the various sections of the work, as—

   New shop front.

   New staircase from first to second floor.

   Works in vaults, etc.

SECTION II:

THE ORDER OF A SPECIFICATION.

The sequence of the *Items* of a specification is a matter of uncertainty with many writers. Any person with an extensive acquaintance with specifications will recall experiences in which a protracted search through a specification for an item has finished in its discovery in a position where no one in their senses would expect to find it. The variety of practice in this respect is painful to those persons who, anxious for a greater similarity in all architectural practice are of opinion that the adoption of a uniform order would establish precedents of meaning and intention which could not fail to prove valuable. The comparison of the work of solicitors and architects is instructive. The procedure in an action at law is settled and uniform, all the forms are referable to an accepted type, a legal process (speaking generally) may be taken up at any stage of its progress by a qualified solicitor other than the original one, and with a confidence as to what has already been done. The course of a building contract is most uncertain, and the entrance upon the half-finished work of another architect or surveyor is difficult.

The initiation of building schemes and their conduct might be founded upon more uniform and regular principles to the advantage of every one concerned.

But whether the student permanently adopts the following order or not, he will derive benefit from a thorough familiarity with a systematic arrangement, which he can afterwards modify according to his taste.

The order commonly adopted for the trade is one which is easily divisible into two main sections, carcase and finishings, as follows :—

Preliminary and provisions
Excavator
Drains
Bricklayer
Mason
Waller
Slater or tiler
Slate mason
Carpenter
Joiner and ironmonger
Founders and smiths
Gasfitter and bellhanger
Plasterer
Plumber and zinc worker
Glazier
Painter
Paperhanger
Ventilation

In the following list this order is slightly changed :—

ORDER OF A SPECIFICATION FOR ONE CONTRACTOR IN ALL TRADES.

Subordinate specifications, as for stables, conservatories, boundary walls, etc., will follow a similar order.

Heading
List of the drawings
Conditions of contract

Preliminary and General—
Description of the position of the site
Description of the work and any cautions to the contractor as to the character of the work
Directions as to the carrying on of the business, or the order in which parts of the work shall be done
Directions as to alternative prices or the division of the amounts
Definition of words
Return of drawings and models
New work to match old
Water
Scaffolding
Sheds
Protection of materials
Protection of work generally
Protection of sub-contractors' work
Screens
Making good damage
Watching and lighting
Pumping
Removal of rubbish
Afford facilities
Latrines
Attendance
Office for clerk of works
Braziers and fuel
Measures for materials
Disposal of hard rubbish
Shoring
Hoarding
Make good roads and footways
Enclosure of site
Temporary openings
Unloading and storing of sub-contractors' materials

Supply of water for sub-contractors
Pulling down old work

Provisions—
Definition of prime cost
Amounts provided (if not at the end of each trade)
Quantity of materials provided (if not at the end of each trade)
Statement of items of work which will be supplied and paid for by the building owner

Excavator—
Definition of datum line
Remove turf
Surface digging
Terrace
Digging of trenches and basement
Filling in to foundations
Digging for underpinning
Lime concrete in trenches
Do. under pavings
Do. over arches
Cement concrete in trenches
Do. under pavings or floors
Do. over arches
Breeze concrete in floors
Do. for casing girders
Dry rubbish
Clay puddle
Strutting and planking
Provision of quantities of materials as digging or concrete, if not placed in the section "Provisions"

Concrete Walling—
Special directions
Composition of the concrete

Drains—
Materials, description
Description of pipes and laying
Lump holes
Inspection pits (these may be designated by consecutive letters or numbers)
Brick cesspools
Syphons
Disconnecting traps
Gulleys
Grease traps, or grease gulleys
Rain-water tanks
Flushing tanks
Ventilating pipes and inlet valves
Iron drains
Connection of drains with sewer
Sewers
If the rain-water system is a separate one, describe it separately but in the same order
Agricultural drains

Bricklayer—
Description of bricks
Do. lime
Do. sand
Do. cement
Do. mortar
Do. brickwork
Wetting the bricks
Brick backing to stonework
Flushing
Hollow walls
Footings
Sleeper walls
Arches

Vaulting
Inverts
Work in cement
Underpinning
Bonding new and old
Level for raising
Fires complete, flue-plates, soot doors
Damp-proof courses
Hoop iron

Sundries—

Air bricks and gratings and small metal articles
Bed and point frames
Levelling up on top of riveted girders
Cuttings
Oversailings
Rake out and point flashings
Quoins
Lime whitening
Pavings
Cements
Brick
Asphalte (when there is much and various asphalte work describe it in a separate section)
Tiles
Plate safe

Facings—

NOTE.—Keep the external and internal work separate.
Stock facing and all its adjuncts
Facing of better bricks and all the adjuncts, as—
Brickwork for carving
Arches
Plinths
Sills
String courses or cornices
Copings
Panels
Niches
Glazed facings
Do. quoins
Do. string courses
Do. copings
Glaze hanging tiles
Adjuncts to the last
Faïence
Adjuncts to the last
Boundary walls (if these are extensive they are best described as a separate section in all trades)
Furnace chimney shafts (or may be described as a separate section in all trades)
Boiler settings
Heating channels
Provision of quantity of material

Waller—

Backing and internal quoins to rubble walling

Terra-cotta—

Description of quality
Filling
Setting
Cleaning

Terra-cotta, if a separate contract—

(The amount for the terra-cotta and delivery will appear in the list of provisional sums)
Fixing only, description of
Manufacture and delivery, description of

Mason—

NOTE.—Keep the various kinds of stone in separate sections

Quality of materials generally

Injury

Quarry working and delivery (or this may be a separate contract)

Beds of stone (if not marked in details) either describing the beds of the various stones or referring the bedding to a general principle

Portland, Bath, or other stone

Specific description of quality and finish, and state where it is to be used

Yorkshire Stone—

Templates

Bases

Cover stones

Corbelling

Hearths

Pavings

Thresholds

Steps

Curbs

Copings

Window sills

Staircases

Chimney pieces

Carvings

Granite—

Structural

Description of quality and finish

Beds of stone (if not marked in details)

The amount for granite and its delivery may be a separate contract, in which case it will appear in the list of provisional sums

Spur stones

Curbs

Paving

Marble—

Description of materials and finish

Counter tops

Lavatory tops

Steps

Wall linings

Chimney pieces (or the chimney pieces may be (as is most frequently the case) a provisional sum, but state clearly who is to fix them)

Waller—

Rubble Walls—

General description of the stone, labour, bond, and mortar

Footings

Facings

Arches

Quoins

What parts in cement

Rubble Facing—

Description of bond, labour, and mortar

Arches

Quoins

What parts in cement

Flint Facing—

Description and how finished, set, and pointed, and the mortar

Slater—

Description of materials, gauge,

and nails (battens or boarding in Carpenter)
Eaves
Verges
Hips
Ridges
Hip knobs
Glass slates
Torching

Vertical Slating—
Description of materials, gauge, nails
Eaves
Angles
Clause for leaving perfect and cleaning out gutters

Tiler—
Description of materials, gauge, nails and laths
Verges
Hips
Valleys
Tile and half
Ridges
Hip knobs

Vertical Tiling—
Description of materials, gauge, nails and laths
Eaves
Angles
Clause for leaving perfect and cleaning out gutters

Stone Slates—
Description of materials, gauge, nails
Verges
Hips
Ridges
Hip knobs
Clause for leaving perfect and cleaning out gutters

Shingles—
Description of shingles, gauge, nails
Verges
Hips
Eaves

Slate Mason—
Shelves
Lavatory tops
Urinal backs, ends and divisions
Cantilevers
Cisterns and their ironwork
Mat sinkings
Enamelled slate

Carpenter—
Materials
Distances apart of timbers
Cutting into scantlings
Trimmers
Lintels
Wood bricks, pads or palettes
Centering
Fillet soffites
Bracketing
Cradling
Dowels
Scarpings
Cleats
Finished sizes (descriptive clause if they are required)
Wrought faces, where
Definition of allowance for wrought faces

Roofs—

- Plates
- Trusses
- Purlins
- Ridges
- Plates
- Valleys
- Hips
- Rafters
- Slating battens
- Boarding
- Felt
- Sprockets
- Rafter feet
- Eaves
- Fascias
- Tilting fillets
- Barge boards
- Gutters
- Cesspools
- Snow boards
- Ways in roof
- Ceiling joists

Flats—

- Plates
- Joists
- Boarding
- Drips
- Rolls
- Gutters
- Cesspools
- Dormers
- Fleches
- Skylights
- Lanterns
- Traps
- Quarter partitions
- Trussed do.
- Bridging pieces
- Bressummers

Floors—

Ground Floor—

- Plates
- Ground joists

First Floor—

- Girders
- Binders
- Plates
- Joists

Second Floor—

- Order as first floor
- Herring-bone or other strutting
- Sound boarding
- Half timbering
- Fences (if in considerable quantity they may be a separate section)
- Provision of material

Joiner and Ironmonger—

- Describe with each piece of joinery the ironmongery it requires, as butts, hinges, bolts, locks, etc.
- Materials
- Glued joints
- Finished sizes (not necessary to mention this if the ordinary practice as to thicknesses is intended)
- Drying room and priming
- Secret fixing
- Linings to be tongued
- Dowels
- Iron cramps to frames of external openings
- Dovetailed backings
- Floors over pipes
- Sawdust on floors

Iron tongues and special work to sashes and frames
Canvassing
Architrave bases
Pipe casing
Boards to support lead pipes
Grounds
Oak joinery generally
Ironmongery
Iron cramps
Attendances
Preparation for safes

Topmost Floor or Third Floor—
Floors in deal
Do. in pitch pine
Do. in oak
Do. of parquetry
Steps between two levels
Dados and skirtings in deal
Do. do. in pitch pine
Do. do. in oak
Windows in deal
Do. in pitch pine
Do. in oak
Shutters in deal
Do. in pitch pine
Do. in oak
Doors in deal
Do. in pitch pine
Do. in oak
Fittings in deal
Do. in pitch pine
Do. in oak
Do. in mahogany

Second Floor—
Order as last

First Floor—
Order as last

Ground Floor—
Order as last
External and internal doors respectively should be kept together

Staircases—
In deal
In pitch pine
In oak
The wooden adjuncts to the stone staircases, as handrails and their brackets, enclosures beneath them, etc.

Founder and Smith—
Cast Iron—
Description of iron and castings
Testing
Planing
Columns
Stanchions
Eaves gutters
Rain-water pipes
Sundries in cast iron
Staircases
Coal plates
Ranges, stoves, coppers

Structural Rolled Iron or Steel—
Description of materials and work
Joists
Girders
Distance pieces
Stanchions
Roof trusses

Wrought Iron—
Description of materials and workmanship

Bolts
Flitch plates
Guard bars
Balustrades
Gratings
Sashes and casements
Scrapers
Doors in party-walls
Safe doors and frames
Iron stages and ladders
Snow guards
Lifts
Provision of iron

Gasfitter—

Description of pipes
Sizes of pipes to various points
Fittings (often a provisional sum)
Stop-cocks
By-pass
Regulating valves
Governors
Meter and main cock
Connection with main
Attendances (or in preamble of Joiner)

Bellhanger—

Description of bells and hanging
Lists of proposed bells, and where they are to ring
Pulls
Bell board (or describe in the section Fittings, with Joiner)
Speaking tubes
Attendance

Electric Bells—

Description of materials
List of bells and fittings, and where they are to ring
Switches
Attendance (or in preamble of Joiner)

Plasterer—

If a large quantity of work, the description should be in two sections, external and internal.
Description of materials—
Lime
Sand
Laths
Hair
Coarse stuff
Portland cement
Keene's do.
Screeds to mouldings
Whitening (or in Painter)
Pugging
Render and set
Do. float and set
Lath, plaster, float and set
Trowelled stucco
Metal lathing
Fibrous plaster, or if much of it a separate section, cut out cracks and blisters

Fine Plaster—

Cornices
Enrichments
Geometrical ribbed ceilings

Portland Cement—

Internal.
Floated faces to receive tiling
Hearths
Skirtings and dados
Window backs
Cornices

Mosaic—

External work.

Describe where it is to be done and how, as Portland cement, plain face, cornices, rustics

Rough cast

Incised plastering

Cement wash

Keene's Cement—

Angles

Skirtings

Dados

Archways and recesses

Fibrous Plaster—

Walls

Ceilings

Cornices

Wall Tiling—

Tiling and fixing

Cappings

Skirtings

Angles

Floor tiling

Plumber—

Externally.

Description of materials

Wire covers

Flashings

Aprons

Stepped flashings

Lead wedging

Hips

Valleys

Ridges

Soakers

Flats

Gutters

Cesspools

Socket pipes

Covering of brick strings and cornices

Secret gutters

Lead rain-water pipes

Do. heads

Lining to stone gutters

Hip knobs

Lead work to dormers, lanterns, spires, fleches, traps, skylights

Internally.

Description of materials and workmanship

Cuttings

Soldered joints

Bends

Tucks and collars

Protection of pipes

Securing pipes to roofs

Finish of top of soil pipes

Iron stays

Table of weight of pipes and definition of the words "strong" and "middling" if used

Taps

Stop-cocks

Labels

Traps

Flap valves

Testing of pipes

Connections of soil pipes with drains

Anti-syphonage

Safes

Cisterns with their wastes and overflows, and the connectors of either

Protection of cisterns

W.C. apparatus, with their soil

- pipes, thimbles, cowls, gratings, etc.
- Waste-preventing cisterns, with their overflows and flushing pipes
- Anti-syphonage pipes
- Slop sinks
- Sinks with their brasswork, wastes, and anti-syphonages
- Lead lining to sinks, and their brasswork, wastes, and anti-syphonages
- Covering to draining boards
- Urinals, with their wastes
- Baths, with their wastes and valves
- Lavatories, with their wastes
- Safes, with their wastes
- Services from cisterns to apparatus
- Supply from main to cistern
- Stop-cocks
- Testing
- Emptying tap
- Protection of pipes
- Connection with main
- Iron shields to lower parts of external soil pipes
- Water-softening apparatus

Hot Water Supply—

- Description of pipes
- Cylinder and its casing
- Flow and return
- Branches and valves
- Expansion pipe
- Safety valve
- Stop-cocks
- Geyser, and laying on of gas and water thereto

Fire Mains—

- Materials
- Smith's composition
- Painting pipes
- Brackets
- Sluice valve and its chamber and cover
- Pipes
- Hydrants
- Pressure gauge
- Hose
- Buckets
- Testing

Zinc Worker—

- Description of materials and labour
- Flashings
- Aprons
- Stepped flashings
- Soakers
- Hips
- Valleys
- Ridges
- Flats
- Gutters
- Ornamental zinc work
- Eaves gutters
- Rain-water pipes
- Condensation gutters

Glazier—

- Description of glass and workmanship
- Wash leather
- Black edges, clips, templates
- Sheet glass
- Fluted sheet
- Rolled plates
- Rough do.
- British polished do.

Silvered plates
Embossed glass
Brilliant cutting
Bevelled glass
Iron casements
Glass ventilators
Lead lights
Pavement lights
Stall board lights
Leave clean and perfect

Painter—
Description of materials
Painting on iron
Painting on wood
Painting gas pipes
Graining and varnishing
Staining and varnishing
French polishing
Oil and rub up
Gilding
Distemper
Writing
Touch up

Paperhanger—
Description of preparation of walls and hanging
Battening and canvas
Papers, the price per piece to the various rooms, floor by floor
Lincrusta anaglyfa, etc., friezes, dados, or ceilings
Varnishing papers
Painting papers

Ventilation—
The various kinds of ventilators and their position and work in all trades

Lightning Conductors—
Maker to be approved
Testing
Conductivity
Joints
Earth plates
Rope or rod and points
Clips and coupling sockets
Protection

Stables—
(Subordinate to a specification for a house to which it is an adjunct). The principle adopted in the writing of subordinate specifications is to repeat no general items, but to describe the items specially required for the building in question.

General—
Clause about materials and general items
Provisions
Concrete under pavings

Excavator and Drains—
Drains
Cesspools
Gulleys

Bricklayer—
Work in cement
Fires
Limewhiting
Pavings
Iron articles fixed by bricklayer
Facings
Arches
Plinths

Sills
String courses or cornices
Copings of brick
Panels

Mason—
Templates
Hearths
Steps or thresholds
Window sills
Copings of stone
Staircases
Chimney pieces

Slater—
Description of slating
Hips
Ridges
Glass slates
Torching
Vertical slating

Tiler—
Description of tiling
Tile and half
Hips
Valleys
Ridges
Verges
Vertical tiling
Eaves
Angles
Fleches

Carpenter—
Materials
Wrought faces
Plates and lintels

Roofs—
Trusses
Purlins
Rafters
Ridges
Valleys
Hips
Slating battens
Boarding
Felt ✓
Sprockets
Rafter feet
Eaves
Fascias
Tilting fillets
Barge boards
Ways in roof
Ceiling joists
Dormers
Fleches
Skylights
Lanterns
Traps
Quarter partitions
Trussed do.
Plates
Floor joists
Herring-bone strutting
Provision of material

Joiner and Ironmonger—
Floors
Skirtings
Windows
Doors and gates
Metal fittings of stable and harness room
Hay shoot
Wall ladder
Corn bin and shoot
Staircases

Founder and Smith—
Eaves gutters
Rain-water pipes

Sundries in cast iron
Stable fittings (or in the provisions, or with their joinery)
Iron or steel joists
Bolts
Flitch plates
Guard bars
Balustrades
Gratings
Sashes and casements
Gas pipes } or a separate section
Do. brackets }

Bellhanger—
Description of bells and hanging
List of bells

Gasfitter—
Sizes of pipes
Fittings
Stop cocks
Meter and main cock
Connection with main

Plasterer—
Render and set
Render, float and set
Lath, plaster, float and set
Cement work

Plumber—
Soakers
Lead to dormers or turrets
Cisterns, with their wastes and overflows
Protection of cisterns
W.C. apparatus, with their soil pipes
Waste-preventing cisterns and flushing pipes
Anti-syphonage pipes
Services from cisterns to apparatus
Supply from main to cistern
Stop cocks
Protection of pipes

Zinc Worker—
Description of materials and labour
Flashings
Aprons
Stepped flashings
Soakers
Hips
Valleys
Ridges
Flats
Gutters
Eaves gutters
Rain-water pipes

Glazier—
Sheet glass and where used
Rolled plate do.
Lead lights do.
Iron casements

Painter—
On wood
Graining and varnishing
Staining and varnishing
Oiling and rubbing
Distemper

SUBORDINATE SPECIFICATIONS.

Boundary Walls—
A detail should be referred to or the heights of walls described
Clauses about materials and general items
Provisions

Concrete
Piers
Facings
Copings
Thresholds
Pier caps
Hinge stones
Lock stones
Fend stones
Gates and their ironmongery

Conservatories—
Clause about materials and general items
Provisions
Concrete under pavings
Drains
Cesspools
Gulleys

Bricklayer—
Work in cement
Setting boiler
Iron articles fixed by bricklayer
Limewhiting
Pavings
Facings
Arches
Plinths

Mason—
Templates
Steps

Tiler—
Tiling
Slate shelves

Carpenter—
Materials
Wrought faces
Plates

Roofs—
Trusses
Purlins
Rafters
Ridges
Valleys
Hips
Fascias
Barge boards
Skylights
Lanterns

Joiner—
Sills
Posts
Mullions
Transomes
Sashes
Doors
Fittings
Gear

Smith—
Eaves gutters
Rain-water pipes
Sundries in iron
Wire work

Plasterer—
Render, float and set

Plumber—
Flashings
Aprons
Lead to finials

Glazier—
Painter—
On wood
Distemper

SECTION III:

SPECIFICATION OF A HOUSE WITH STABLES, CONSERVATORY, BOUNDARY WALLS, &c.

NOTE.—*The Notes referred to incidentally are the "Notes on Sections," p. 395, which contain much information on the practical details of specifying.*

Specification of work to be done in building a house, with stables, conservatory, boundary walls, etc., at Leatherhead, Surrey, for John Williams, Esq.

JOHN GREEN, *Architect*,
High Street,
Leatherhead.

January, 1898.

List of Drawings.

CLAUSE
1. No. 1. Basement Plan.
,, 2. Ground Floor Plan.
,, 3. First Floor Plan.
,, 4. Attic Plan.
,, 5. North Elevation.
,, 6. South Elevation,
&c.

And further details to be supplied.

It is not a common practice to insert a list of the drawings as above, and if the drawings and specification are signed by the parties to the contract it is superfluous.

The drawings are commonly identified by a note on each.

"This is one of the drawings referred to in the contract dated ," each drawing being signed by the parties to the contract.

Conditions follow here.

PRELIMINARY AND GENERAL.—*See Notes, p. 396.*

CLAUSE

Nature of the Work. 2. The work consists of the erection of a house of three storeys, with conservatory, outbuildings, stabling, and boundary walls.

Site. The site is on the north side of the road to Epsom, on the eastern side of a pond about a mile from Leatherhead.

The word "best." 3. "The word 'best,' when used in the specification, shall be taken in its ordinary English sense, notwithstanding any trade custom to the contrary."

Or,

All materials and workmanship to be of the best quality of their respective kinds, and by the word "best" it is to be understood that there is no better quality.

The trade terms, "Best best," "Double best," etc., afford a reason for the use of such clauses as the foregoing.

The word "supply." 4. The word "supply" in this specification to include the term "provide and fix" as usually understood.

The use of the word "provide" should be confined to the provision of sums of money and specific quantities of materials. "Provide and fix" is a form of common use in the body of a specification. Mr. Rickman's suggestion of the substitution of the word "supply" is a reasonable one.

The word "local." 4a. The word "local," as applied to materials, shall mean the nearest locality in which the material is procurable, which shall, in the opinion of the architect, satisfy the stipulations of the specification.

Drawings. 5. All the general drawings, tracings, details, moulds, models, etc., are to be restored to the architect without any copies being kept, and the final certificate will not be granted until this has been done.

Water. 6. Supply water for the works, and any temporary plumbers' work or storage of water.

Scaffolding. *See Notes, p. 395.* 7. Supply all scaffolding, rods, stakes, and labour required in setting out the works.

Sheds. 8. Supply all sheds required for keeping material under cover, and for carrying out the works.

Keep Lime, &c., under Cover. 9. Keep lime, facing bricks, and other materials under cover.

Cover Walling. 10. Cover the walling during inclement weather; supply all requisite temporary lights, doors, water-shoots, coverings to stonework, tile-pieces to steps, shoring, and other requisite protection to the whole of the works.

Screens. 11. Supply all requisite temporary paper or canvas screens at the discretion of the architect.

Make Good. 12. Make good and reinstate all injury from frost, wet, carelessness, or any other cause arising, and especially make good all pointing to brickwork, roofing, etc., after injury from frost.

Watching and Lighting. 13. Supply all requisite watching and lighting during the progress of the works.

> If any special lighting, as in the case of sub-basements or work done in ill-lighted positions, it should be particularly described.

Pumping, &c. 14. Keep foundations free from water, do all temporary draining, and all baling and pumping required.

Remove Rubbish, &c. 15. Clear away all dirt and rubbish and superfluous materials as they accumulate. Wash floors at completion, and leave the whole of the works and premises in a clean and orderly condition.

Afford Facilities. 16. Afford facilities to any other parties employed upon the buildings, so that their works may proceed during the progress of the contract, and give such persons the use of ordinary scaffolding and ladders.

Latrines. 17. Supply proper latrines for the workmen, keep same in a clean, orderly, and decent condition. Empty from time to time as may be required, and remove at completion.

Attendances. *See Notes, p.* 398. 18. Each trade to attend on all others, and to do all jobbing throughout the works.

19. The engineers, gasfitters and electricians will do their own cutting away and making good, and will supply their own attendance, and will erect and take down their special scaffolds. Contractor shall allow them the use of his ordinary scaffolding and ladders as constructed, and

also such plant as they shall require for the construction of special scaffolds.

> Some architects prefer that these tradesmen rather than the general contractor should do the above work.
> The attendances on gasfitter and hot-water work should be specially mentioned either with those trades or here, as it is maintained by some that the stipulation "all trades" does not include these.

Office for Clerk of Works. 19a. Supply an office for clerk of works with drawing-board and two drawers, stove, and fireplace all to the architect's satisfaction, and supply the requisite firing, light, and attendance (sometimes the size of the office is prescribed).

Measures. *See Notes, p.* 404. 20. Supply wooden boxes as measures for those purposes where definite proportions of materials are specified, as for concrete.

Brick or Stone Rubbish. 21. All hard dry stone or brick rubbish to be reserved, filled in as far as required, and well rammed until quite solid, under the floors and over the drains, the remainder to be carted away.

Shoring. *See Notes, p.* 395. 22. Do all necessary shoring to adjoining property, etc. Contractor to be responsible for, and make good, any and all damage consequent upon these works.

Hoarding. 23. Supply and fix a close boarded hoarding 7 ft. high and the whole length of the frontage, with two returns, gate, and fans, planked footway, post-and-rail fence, etc., to the satisfaction of the local authorities. Alter and shift this hoarding as may be necessary during the progress of the works, and remove at completion. No advertisements will be permitted.

> Where doubt is possible state the length of the hoarding.

Roads and Footways. 24. Take up paving as required for the works, deposit paving and relay, and make good road and footway to the satisfaction of the local authorities, or pay them for doing the work.

Inclose Site. 25. Inclose the site for a space of 20 ft. beyond the building on each side, with an approved post-and-rail fence, and prevent the workmen from trespassing upon any

part of the ground beyond that inclosed, and make good any damage from that cause—necessary in a garden or park.

Protection of Sub-Contractor's Work.

26. The contractor to case and otherwise protect any of the work done by other tradesmen, and to be responsible for, and make good, or pay for the making good, of any work which may suffer from want of such casing or protection.

Temporary Openings.

27. Leave temporary openings in roofs, walls, or floors as may be required or directed for the getting in of cisterns, boilers, machinery, etc., and make good afterwards in all trades.

When a sum of money has been provided for constructional ironwork, and it only includes smith's time in fixing:—

Unload Iron Work supplied.

28. "Unload, get into building, deposit, hoist and assist in fixing tons of iron joists, girders and columns."

When a sum of money has been provided for terra-cotta:—

Contractor to assist Manufacturer of Terra Cotta.

29. "The contractor to assist the manufacturer of terra-cotta in setting out, and shall unpack, store and protect it, and be responsible for, and make good, damage." The fixing would be described with the terra-cotta.

When a separate contract is made for granite and the builder fixes:—

Contractor to assist Sub-Contractor for Granite.

30. "The general contractor to assist the contractor for the granite work in setting out, and shall furnish any necessary particulars of the contemplated work. Shall unpack, store, and protect it, and be responsible for, and make good, any damage to the stone."

When a sum of money is provided for fibrous plaster work:—

Contractor to assist Sub-Contractor for Fibrous Plaster.

31. "Supply water to the fibrous plaster manufacturer; assist him to unload his materials and protect them. Arrange with him as to time for the execution of his work after the grounds are fixed, erect scaffolding for him, allow him the use of it, and remove it afterwards. Clear away any rubbish he may make."

When a separate contract is made for the manufacture and delivery of faïence:—

Contractor to assist Sub-Contractor for Faïence.

32. "The general contractor shall prepare all the cement floated faces, supply the necessary water, assistance in setting out, cut away and make good structural work, sheds for the deposit of the material, case and protect the work from injury before and after its fixing, supply and erect scaffolding and afford use of ladders, and remove all at completion. He shall also supply the necessary workshops for the use of the modeller, as may be directed by the architect." Any piece of faïence which may be damaged for want of protection shall be paid for by the general contractor.

PROVISIONS.—*See Notes, p.* 396.

Treatment of Provisional Sums.

33. "The sums below mentioned are to be expended as the architect may direct, or such sums shall be paid net to the tradesmen selected by the architect on his certificate, or they may be entirely deducted, whichever the architect may decide. If the contractor desires a profit, he must therefore add to it the amounts named."

Letters P.C.

34. "The letters P.C., or the words prime cost, shall mean the price at the manufactory after deducting trade discount, but not discount for cash."

Carriage, Packing and Unpacking.

35. "Allow on all provisions for carriage and packing and unpacking."

Or,

"The following provisions are to be expended as the architect may direct, or deducted in full or in part from the amount of contract; but when the amounts are paid by the contractor they are subject to a discount of 10 per cent."

Or,

"In all cases where letters P.C. are made use of in this specification, they are intended to imply the published catalogue price, and the architect shall be empowered if he thinks proper to order the articles of any special manufacturer to the full value of the sum named."

Or,

"All provisional items are understood to bear a

Carriage, Packing and Unpacking.

discount of 10 per cent. to the contractor, and he shall be entitled to no further profits on these provisional amounts unless he should obtain a cash discount from the persons who are carrying out the works for making cash advances to them before these sums have been included in any certificate. All receipts to be produced if required."

36. Provide for 100 ft. run of iron railing and painting	£100
Provide for attendance on heating engineer . .	£150
Provide for external and internal plumbing, the P.C. sum of £500. The work is to be done by Messrs. Johnson, of —— Street, and the contractor must allow them the use of his ordinary scaffolding and ladders, and render them all reasonable facilities for the execution of their work	£500
Provide for carving	£120
Provide for contingencies	£100

It is best to state the quantity of material, as well as the amount, which is a subject of provision. The above are instances of provisions thus treated.

EXCAVATOR.—*See Notes, p.* 398.

Materials. 37. For the quality of the materials, see "Bricklayer."

Sand and Gravel. 38. Sand and gravel sufficient for the builder's purposes may be dug upon the site, but none is to be carted away, and the contractor should fill up any excavation he may make with sound earth or hard dry rubbish, well rammed.

Or,

The contractor is not to dig for sand beyond the excavation required for the building.

Or,

Any sand or gravel found upon the site shall be allowed for by the contractor at the market price of sand or gravel delivered, after deducting the cost of carting away a yard of earth measured before digging.

Datum Line. 39. The levels marked on the block plan are referable

to a datum 10 ft. below a horizontal notch cut into the gate-post 14 ft. from the north-western angle of the site.

Remove Turf. 40. Cut neatly, roll, and remove the turf from the whole of the site of the house, kitchen court, stable and stable yard, and 3 ft. beyond each way, wheel, deposit, and stack in such part of the site as the gardener shall direct.

Often the turf is useless, and need not be mentioned.

Surface Digging. 41. Remove the surface earth down to the level of the bottom of the concrete under the pavings or beneath the wood floors, separate the vegetable soil, wheel and deposit that and the surplus where directed by the gardener, or cart away the surplus.

Or,

The surplus earth shall be deposited within the walls of the building, well watered, rammed and rolled, to receive the rubbish beneath the pavings.

The earth is sometimes used as described in the last clause, when a building is built on a steep declivity.

Terrace. 42. Deposit the surplus earth from basement and trenches, &c., and supply any further earth necessary to form the terrace, as shown on the drawings, thoroughly ram, water and roll, shape and level it as required.

Digging for Trenches, &c. 43. Dig for the trenches and basement, as shown on the drawings, and ram the bottoms before putting in the concrete.

The concrete shall not be put in until the architect has approved of the bottoms.

Fill in to Foundations. 44. Fill in to the foundations with the dryest of the excavated earth as the work proceeds, and well ram.

Lime Concrete. *See Notes, p.* 404. 45. The concrete for trenches to be of the depth shown, composed of 1 part freshly ground Dorking or Merstham stone lime, 5 parts of clean ballast (no stones to measure more than 2 in. either way), and 1 of sand, thrown into trenches and well rammed while wet.

Concrete under Pavings. 46. Lay beneath all brick pavings lime concrete as last 6 in. thick.

Concrete over Vaults. 47. Lay over the arches and fill in the haunches of arches of vaults similar concrete, 6 in. thick over the crown of the vault.

Cement Concrete. 48. The cement concrete to be mixed in the same proportions as described for the lime concrete, but cement substituted for the lime.

Cement Concrete under Pavings. 49. Lay cement concrete as last described, but 6 in. thick under all tile and cement pavings.

Breeze Concrete. 50. The breeze concrete to be composed of 1 part of Portland cement, 4 parts clean ballast, and 2 parts of clean, coarse, well-screened coke breeze.

Or,

> The breeze concrete to be composed of 1 part of Portland cement, 2 parts clean fine Thames ballast, and 3 parts of clean, coarse, well-screened coke breeze.
>
> The breeze concrete, in which iron is embedded, shall be mixed so wet that it shall be completely impervious when dry.

Construct the floors, except basement floor, with breeze concrete 9 in. thick.

Concrete in Girder Casing. 51. Case the girders of the floors above described with similar concrete, on a backing of strong galvanized iron wire netting, securely attached to the girders, the concrete to be of the thickness shown on the detail drawing No. 65.

Dry Rubbish. *See Notes, p.* 405. 52. Fill in where necessary to receive concrete hard, dry brick, or stone rubbish well rammed.

Clay Puddle. 53. Fill in and ram thoroughly well-tempered clay puddle, 12 in. thick from the bottom of the concrete in trenches to the level of finished surface of ground, for the whole length of the southern and western walls.

Strutting and Planking. 54. Do all requisite strutting and planking.

Provision of Material. 55. Provide 60 yards cube of cement concrete as described, laid in trenches.

Provide 30 yards cube of digging, 6 ft. deep, and carting away and strutting and planking.

Provide 30 yards cube of digging, from 6 ft. to 12 ft. deep, and carting away and strutting and planking.

DRAINS (AS PROVISION).—*See Notes, p.* 405.

> To the heading is often added the above words in parentheses. The original intention is so often varied

that some architects habitually treat this work as a provision. In any case a drain plan should be prepared before quantities are prepared or the work submitted to tender.

Quality.

56. The drains to be glazed stoneware socketed pipes, equal to the best Staffordshire, laid to an even fall of 2 in. in 10 ft. in trenches on a well-rammed bed, jointed in cement, and the joints puddled around with well-tempered clay, cleaned out and tested by water or other approved test at completion and left perfect. The pipes to be of the sizes shown on drawings, and to have all the necessary bends, junctions, taper-pieces, &c., required.

Bedding in Concrete.

57. The pipes to be embedded in cement concrete, as described in "Excavator," 16 in. by 16 in. for 4 in. pipes, 18 in. by 18 in. for 6 in. pipes, and for larger pipes in proportion. Jointing in clay is inconsistent with this clause. If a more stringent description is preferred, the following or parts of it may be adopted :—

Stoneware Pipes.

58. The drain pipes to be the best glazed stoneware socketed pipes of approved London make, perfectly straight; truly cylindrical, and perfectly smooth as to the interior glaze, to be tested for straightness by the insertion of a cylindrical plug of the full length of the pipe and a quarter of an inch less in diameter than the pipe to be tested. This plug must pass quite freely through every pipe used.

Or,

Stanford's Pipes.

The pipes shall be Doulton's, with Stanford's patent joints, the joints to be wiped clean and then jointed with a mixture of 3 parts of Russian tallow to 1 part of resin, heated and laid on hot with a brush, the pipes to be twisted in the setting and the insides wiped clean.

Or,

Stoneware Pipes.

The stoneware pipes to be best London made glazed socketed pipes, perfectly cylindrical, straight, free from blisters, flaws, cracks, and other defects. Each pipe to be tested and marked T, the 4 in. pipes to be $\frac{1}{2}$ in. thick, 6 in. pipes $\frac{5}{8}$ in. thick.

Channels and Bends. 59. The channels and bends in manholes to be executed with white glazed channel pipes of Winser's, Broad's or other approved make.

Drains to be Laid in Straight Lines. 60. The drains to be laid truly straight in line and gradient, so that a lighted candle held at one end of the piper line may be seen to be truly concentrical from the other end, the full bore of the pipe showing.

Testing. 61. The contractor will be required, at his own expense, to test the drains in the presence of the architect or his assistant at such time as he may appoint by filling them with water as often as necessary, and proper stoppers, screw plugs, hose, &c., must be supplied.

Relaying Drains at Contractor's Expense. 62. If any drain is found to be leaky, or the test as to straightness is not satisfactory, it shall be taken out and relaid at the contractor's expense.

Embedding Pipes in Concrete. 63. The stoneware pipe drains, traps, &c., are to be jointed and filleted all round with neat Portland cement. The pipes are to be carefully and thoroughly cleaned out on the inside as the work of laying proceeds, and are to be laid on beds of Portland cement concrete, 6 in. thick (7 to 1), and after being tested and approved by the architect are to be flaunched up with concrete on each side to half the diameter of the pipes, and again must be passed by him before being finally covered up, when the concrete shall finish, 16 in. by 16 in. for 4 in. pipes, and 18 in. by 18 in. for 6 in. pipes.

Or,

Joints of Stoneware Pipes. All joints in laying pipe drains shall be made with one strand of tarred yarn and neat cement. The spigot shall be pushed quite home into the socket, the cement shall quite fill the space between spigot and socket, and be finished smooth on the outside.

Planking and Strutting. 64. Do all necessary planking and strutting to the trenches, keep the excavations clear of water, remove old drain pipes where exposed by new trenches, and remove any soil or contaminated earth met with.

Cut out Concrete for Collars of Pipes. 65. The body of the pipes to be laid upon the concrete, and the concrete to be cut out under each collar to allow of sufficient space to make the joint.

Inspection Pits. 66. Build the inspection pits 3 ft. by 2 ft. 6 in. clear, and

Inspection Pits. of the depth required, of 9 in. brickwork in cement, with one course of footings on lime concrete, 12 in. thick, the whole size of excavation. Oversail where required by the difference between size of pit and cover. Strike the joints of brickwork fair on inside of pit. Form bottom of pit of cement concrete, as elsewhere described, of an average thickness of 9 in., the surface falling towards channels, and render and trowel with Portland cement. Bed in the concrete in cement, Winser's (Buckingham Palace Road) enamelled stoneware channels and bends. Cover with Bolding's (South Molton Street) No. 849 galvanized cast-iron cover, 33 in. by 21 in. To every foot in depth of inspection pits which are more than 3 ft. deep, build in a step iron of $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. wrought-iron alternately across the angles.

Gulley. 67. Fix in yard, to receive sink waste, Doulton's (Fig. 15) yard gulley, 11 in. by 11 in. outside, with 15 in. by 15 in. dished cover, and galvanized iron grating, and bed in concrete and connect with drain.

Or,

Build the inspection pits (see Fig. 3) entirely in cement of the sizes marked on the plan of drains and of the depths required, of 9 in. brickwork in cement with one course of footings on cement concrete 12 in. thick the whole size of excavation. Turn segmental arches as shown in two half-brick rings over the part of each chamber not occupied by the movable cover. Face the inside of the pit, including the arch, with best white glazed bricks, with neatly struck joints in cement. Oversail as required to reduce the size of the chamber and to receive the iron cover. Form the bottom of the pit with cement concrete of sufficient thickness to insure a fall to the channels, and render and trowel the

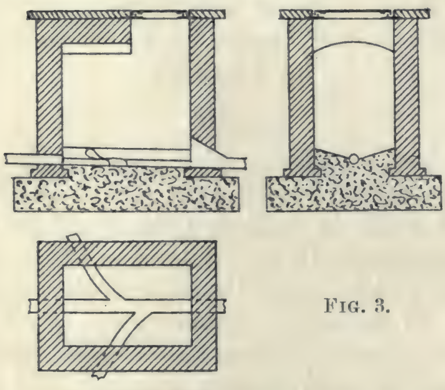

Fig. 3.

Gulley. surface in neat Portland cement. Bed in the concrete in cement, Winser's (Buckingham Palace Road) enamelled stoneware channels and bends. The junctions shall be in all cases parts of the main channel—*i.e.*, the branches shall be at the same level. The channel shall in all cases fall 3 in. in the length of the pit. Supply at the outlet of each pit a Winser's patent white glazed drain chute, with 9 in. by 3 in. York lintel 21 in. long, rubbed on the exposed face, and finely tooled elsewhere.

Render and float with Portland cement, as described for plain face in "Plasterer," ¾ in. thick, the outside of the pit from the concrete to the top.

Cover the pits outside of building with Winser's galvanized inspection cover and frame, 2 ft. 7 in. by 1 ft. 10 in., section 11 form B., with 4 gun-metal bolts and sealed with soft soap.

Cover the pits inside of building with Winser's double sink covers and frames, 2 ft. 7 in. by 1 ft. 10 in., filled in with concrete and paving to match that adjacent, and sealed with soft soap.

Rain-water Gulleys. 68. Supply at foot of each rain-water pipe Doulton's (Lambeth) (Fig. 13) yard gulley, 8 in. by 8 in. outside at top, with dish cover and 9 in. galvanized grating. Connect with drain. Bed in cement concrete.

Syphon. 69. Fix between sewer and manhole F a Field's disconnecting syphon, bedded in cement concrete as described.

Disconnecting Trap. 70. Supply and fix on the sewer side of disconnecting chambers E, F, and H, Crapper's (Marlborough Road, Chelsea) "improved Kenon" disconnecting trap, enveloped in cement concrete, and the brickwork carefully fitted around.

Grease Trap. *See Notes, p. 409.* 71. Supply outside of scullery wall Hellyer's (Newcastle Street, Strand) No. 36 medium size, extra strong, vitrified stoneware grease-intercepting trap, 20 in. by 13 in. by 14½ in. deep, with galvanized cast-iron cover for access to drain, and galvanized cast-iron cover to tank, with india-rubber packing. Bed in cement concrete, and connect with drain and sink waste.

Grease Trap. Grease traps are objectionable. A better plan is a flushing gulley and a flushing cistern, as follows:—

Supply and fix outside scullery wall to receive waste from sink Winser's flushing rim grease gulley, with inlet for flushing pipe and waste, and galvanized iron grating, bedded in cement concrete and connected with drain. Fix the grating in a 3 in. tooled and dished York stone cover, 24 in. by 24 in., rebated and perforated for grating, and bedded in cement.

Supply and fix in scullery on Winser's galvanized iron brackets (list price, 6*s*. per pair), Winser's 40 gallon automatic flushing-tank, with automatic ball valve and silencing pipe. Convey the water from thence to grease gulley by a 3 in. strong lead pipe.

Inlet for Air. 72. Connect manhole A by a length of 4 in. drain pipe with a 6 ft. length of 4 in. galvanized iron rain-water pipe, fixed to the wall adjacent and finished at top with Hellyer's mica valve.

Connect with Sewer. 73. Connect drain with sewer, supply flap-trap or other requirement of the local board (or vestry), and make good roads and footways, or pay the local authorities for doing the work.

Sweeping Arms. 74. At the points marked S on Plan supply junction, bend, and loose stoneware cover, bedded in clay, for convenience of sweeping.

Cess-pit. 75. Build on cement concrete 12 in. thick a cesspool 5 ft. diameter and 6 ft. deep from bottom to springing, all in clear of 9 in. sides of brickwork steined dry, domed over, in 9 in. brickwork in cement mortar. Form eye 2 ft. diameter in dome. Supply tooled 3 in. York cover 2 ft. 9 in. by 2 ft. 9 in., fitted with 3 in. strong wrought-iron ring, with eye bolt let into the stone and run with lead. Connect with the soil drain.

Protection. 76. The contractor shall cover up and protect all manholes and chambers until completion, and shall prevent chips or other rubbish from falling into them.

The foregoing items are the ordinary ones. The following clauses may be substituted or added if preferred, either as additions to the preamble of the trade or in the body of the description:—

Digging. 76A. The trenches shall be excavated in straight lines, and to be open cutting, unless otherwise directed. Timber shall be left in the trenches if necessary, and in such case shall be measured by the Clerk of Works and paid for at contract rates.

The ground returned to the excavation to be well rammed in even layers and reinstated in its former condition, allowance being made for settlement. No person shall walk over the pipes after they are laid until they are covered with earth 2 ft. thick.

Joints of Drains. 76B. Put around the outside of all joints of stoneware pipes a collar of neat Portland cement, 3 in. wide and 1 in. thick.

Iron Drains. *See Notes, p.* 410.

77. The iron drains to be best quality cast-iron socket pipes in 9 ft. lengths, cast vertically and of perfectly true bore. They shall be examined inside before laying, and any rough projections which may exist shall be chipped down to the satisfaction of the clerk of works. If this cannot be done they shall be rejected. The sockets shall be centred bored, and faced at bottom to receive the spigots, which shall be centred accurately, turned on the outside, and cut off flush to fit the bored socket; the ends to go quite home and to be perfectly concentric, and annular space to be left for lead caulking $\frac{7}{16}$ths in. wide and 3 in. deep all round.

The pipes to be free from any wrought-iron pins cast in, and to be well coated inside and out with Dr. Angus Smith's solution, in such a manner that it will not chip off.

The pipes shall be laid on small piers of brick or cement concrete, one cubic foot each, two to a pipe ranged in true gradient, the pipes when laid on them to be lined up and then caulked with blue lead, run in without yarn, and then well set up and tested.

The pipes are to be obtained in suitable lengths, so as to avoid cutting, but should cutting be unavoidable, it is to be done with a proper cutter, and not broken off with hammer or file. Caulking beads to be provided and shrunk on to all cut lengths.

The iron drains shall weigh the following weights per 9 ft. lengths, and shall be of the thickness below specified :—

	cwts.	qrs.	lbs.	Thickness.
9 in.—	4	0	0	$\frac{1}{2}$ in.
6 in.—	2	2	0	$\frac{7}{16}$ in.
5 in.—	2	0	0	$\frac{7}{16}$ in.
4 in.—	1	2	0	$\frac{3}{8}$ in.

Iron Drains Fix cast-iron special channels and bends in the inspection pits to match the drain pipes, and arranged so as not to splash.

In a well-appointed drainage system flushing cisterns are commonly used. If the drains are of large extent, and especially if the fall is small, they are essential. If the rain-water and soil systems are separated, they need only be applied to the soil drains.

Flushing Tank for Drains. 77A. Supply, in the position shown on Plan, Field's patent galvanized wrought-iron automatic flushing tank, to hold 150 gallons, connected with drain. Block up from the paving with 2 piers of 4½ in. salt-glazed brickwork in cement, each pier 4 courses high. (For casing, see "Joiner.")

BRICKLAYER.—*See Notes, p.* 411.

Bricks. 78. The bricks to be sound, hard, well-burnt, truly shaped, ringing bricks, free from all defects.

Firebricks and Staffordshire Bricks. 79. The firebricks shall be best Stourbridge firebricks. The Staffordshire bricks shall be best blue Staffordshire facing bricks, thoroughly vitrified throughout their substance.

Bats, &c. 80. No soft or inferior bricks will be allowed to be used, or bats, except where required for bond.

Bricks to be Approved. 81. All bricks to be approved, and equal to sample to be deposited with the architect before signing of contract.

Lime. 82. The lime to be freshly burnt Dorking or Merstham stone lime.

Sand. 83. The sand to be clean and sharp, free from salt, loam, and other impurities, and washed for cement work.

Or,

The sand to be clean sharp Thames sand, screened and free from salt and other material.

Cement. 84. The cement to be best Portland, from an approved maker; to weigh not less than 112 lbs. per bushel (to be

Cement. capable of passing through a sieve 1,600 meshes to the square inch); to be gauged with an equal quantity of sand (or state proportion); and no cement that has once set to be re-used.

Or,

The cement mortar to be of 1 part of cement to 3 of sand.

The cement is to pass the London County Council tests.

Or,

The cement to be Portland, of the best quality, from an approved manufacturer; to weigh not less than 114 lbs. per striked imperial bushel when poured lightly into the measure; to be slow-setting, uniform in quality, grey in colour; when gauged of such fineness that at least 95 per cent. will pass through a sieve of 2,500 meshes to the square inch, and when gauged pure in the proportion of 9 oz. of water to 40 oz. of cement, and on the following day placed in water and allowed to set for 7 days under water, it shall withstand a tensile strain of at least 400 lbs. per square inch.

Mortar 85. The mortar to be composed of 1 part (by measure) of lime to 3 parts sand; to be mixed (in a mortar mill) in quantities sufficient only for the day's consumption.

The hair mortar to be composed of equal proportions of lime and sand, and to have 1 lb. of sound clean and well-beaten bullock's hair to each cubic foot of mortar.

The blue mortar to be made of 3 parts of fine iron scale, 3 of stone lime, and 2 of Thames sand.

The cement mortar to be mixed in the same proportions as the lime mortar, but cement substituted for the lime.

If selenitic mortar, the lime to be selenitic, used and mixed exactly in accordance with the company's printed instructions.

Wetting Bricks. 86. All bricks to be well wetted before being used, if so required.

Brickwork. 87. The brickwork to be built according to drawings, to be well flushed in with mortar at every course (every joint

filled with mortar), and grouted where directed, and to be laid Old English bond. No 4 courses with their joints to rise more than 12 in. high.

Hollow Walls. *See Notes, p.* 412.

88. Build the hollow walls where shown in two thicknesses, 9 in. and $4\frac{1}{2}$ in. respectively, with a $2\frac{1}{4}$ in. cavity ($15\frac{3}{4}$ in. thick in all), bonded together every 2 ft. in height with Jennings's No. — patent glazed bonding bricks, 14 in. long, placed 18 in. apart (or so many to each superficial yard of wall). The hollow to be kept free of droppings of mortar or rubbish by movable boards or hay bands, as the architect may direct. Leave openings at the base of wall for cleaning out the hollow. Remove any droppings at completion, and brick up the openings uniform with the adjacent work. The inner and outer thicknesses shall be carried up simultaneously.

Probably the clause of conditions, "all materials and workmanship to be of the best quality," would be sufficient to warrant insistence upon thorough flushing without extra charge; but a knowledge of the way in which brickwork is commonly done shows the necessity of describing it.

Bond Brickwork to Stone.

89. Thoroughly bond brickwork and stonework together, and do all requisite cutting and fitting. The brickwork in backing to stonework shall be in cement.

Work to be carried up regularly.

90. The brickwork to be carried up regularly all around the building, no portion to be at any time carried up more than a scaffold high beyond any other part.

Brickwork Casting Joint.

91. All putlog holes to be made good, and all brickwork casting joints to be reinstated.

Footings.

92. All half-brick walls shall have one course of footings, one-brick walls two courses, one-and-a-half brick walls three courses, two-brick walls four courses, two-and-a-half brick walls five courses, &c. (or the footings to be in accordance with the directions of the London Building Act).

The chimney-breasts to have footings of the same height as those of walls from which they project.

Where plinths occur, the footings of walls are not to be increased in width because of them.

Base of Half-brick Partitions.

93. All half-brick partitions shall be carried on 9 in. walls, brought up to ground floor level.

Sleeper Walls.

94. Build on the concrete beneath for the support of ground floors half-brick sleeper walls, with one course of footings and about 5 ft. apart. Build similar sleeper walls against the external walls of each apartment, but carried up from the footings of such walls.

Rough Arches.

95. Turn relieving arches over all lintels, springing from the ends of lintels, except where interfered with by the wall plates, or where there is no abutment, and segmental arches over all openings and recesses, all to be 9 in. deep up to 8 ft. span, the remainder 14 in.

Inverted Arches.

96. Turn inverted arches in two half-brick rings in cement, and the whole thickness of the wall below the sills of the windows of north front.

Work in Cement.
See Notes, p. 413.

97. Build in cement the half-brick partitions, the piers between grouped windows, the four topmost courses of each chimney-stack, &c., stating position of work in each case.

Chimney Bars.
See Notes, p. 414.

98. Turn rough arches over chimney openings, and put to each a $\frac{1}{2}$ in. by 2 in. wrought-iron cambered and caulked chimney bar 2 ft. longer than the width of opening.

Parget and Core Flues.

99. Carry up the flues, and carefully parget and core them.

Trimmer Arches.

100. To all fireplaces having rooms beneath turn a half-brick trimmer arch in cement, levelled up with concrete, with carefully cut skewback and 4 in. by 2 in. feather-edged springer.

Set Stoves.

101. Set the stoves in hard bricks in mortar, fixing the tile and iron slips in cement, including cement backing to the tiles, and setting any extra firebricks.

Contract Smoke Flues.

102. Contract the flues to their general size as near as possible above the fire opening.

Set Range.

103. Set the range, forming any necessary flues, and supplying any firebricks that may be required.

Chimney Pots.

104. Finish each flue at top with a 12 in. length of red unglazed flue-pipe, bedded in the brickwork for a length of 9 in., and flaunched with cement; or describe chimney pots by a number from a trade list.

Render Outside of Chimney Shafts.

105. The brickwork all around the kitchen flue shall be 9 in. thick. Render with cement the faces of chimney

shafts, passing through roof from the ceiling to their emergence from roof.

Render Backs of Fireplaces. 106. Render with cement the backs of all chimney openings from hearth to gathering of flues.

Flue Plates. 107. Build in between certain smoke and ventilating flues, where shown on Plans, Boyd's (Hendry & Patterson, 4, Marlborough Mews, W.) flue plates, thoroughly heated and immersed in boiling Stockholm tar before fixing.

Soot Doors. 108. Supply and fix where directed two 14 in. by 14 in. heavy double wrought-iron soot doors and frames.

Or,

Where the flues are constructed at a less angle than 45° with the horizon, they shall have a 14 in. by 14 in. wrought-iron double soot door and frame fixed where directed.

Flue Pipes. 109. Line the flues, drawn circular on the Plans, with Jennings's (Lambeth Palace Road) 9 in. unglazed terra-cotta flue pipes set in cement. Any necessary bends shall be specially made and of similar terra-cotta.

Vaulting of Cellars. 110. Turn vault in three half-brick rings in blue Staffordshire bricks in cement over the front vaults, oversail this wall with two courses at the springing.

Eye in Vaulting. 111. Form eye 15 in. diameter in two half-brick rings in this vault, and carry up a short shaft of 9 in. work in similar bricks in cement to the underside of the paving of footway. Cut a rebated hole in the paving and fit thereto a Hayward Bros. (Union Street, Borough) 15 in. illuminating coal plate, with protecting ring, strong chain and staple, fit with padlock. P. C. 4*s*. Run the ring with cement.

Vestibule Vaulting. 112. Fill in between the stone ribs of the vaulting over vestibule of principal entrance with brickwork, 4½in. thick, of Lawrence's (Bracknell) best facing bricks, cut, rubbed, gauged, and set in fine putty, coursed to detail, and carefully fitted to the stonework.

Damp-proof Courses. *See Notes, p.* 415. 113. Lay in walls of main building and offices at the level directed a damp-proof course of Pyrimont Seyssell asphalte ½ in. thick.

Lay in walls of outhouses immediately below floor level a damp-proof course ½ in. thick of pitch, tar, and sand boiled together and laid hot in the walls.

Or,

A damp-proof course of two courses of stout slates, breaking joint in cement, the edges neatly cut and pointed with cement.

Hoop Iron. *See Notes, p.* 416.

114. Lay on all walls, immediately below plates of first floor, second floor, and roof, two tiers of one row to each half-brick in thickness of wall, of $1\frac{1}{4}$ in. by $\frac{1}{16}$ in. hoop iron, lapped together at joints and angles, these two tiers to be laid in three courses of brickwork in cement.

In all cases where the ends of joists are built into the walls, supply instead of a wooden wall plate two rows of 2 in. by $\frac{1}{8}$ in. hoop iron.

Lay in each half-brick partition at every fourth course of its height a line of $1\frac{1}{4}$ in. by $\frac{1}{16}$ in. hoop iron.

Air Bricks

115. Supply and fix where directed twenty-four 9 in. by 6 in. cast-iron ornamental air bricks, form cranked openings through the walls, and render with cement.

Gratings.

116. Fix in eastern wall of wood shed two Macfarlane's (Glasgow) $1\frac{1}{2}$ in. by 18 in. by 12 in. cast-iron ornamental gratings (No. — in catalogue), and four cranked openings through the wall, rendered in cement, with 3 in. finely tooled all around lintel 27 in. long and of width equal to the thickness of wall.

Iron Corbels

117. Support the plate of flat adjoining the western wall of kitchen by six wrought-iron corbels, of 2 in. by $\frac{1}{2}$ in. iron and 14 in. long, pinned into the wall.

Bed and Point Frames.

118. Bed in lime and hair, and point with cement all door and window frames.

Levelling on Top of Riveted Girders.

119. Level up on the top of riveted girders with plain tiles and cement.

Cuttings.

120. Do all necessary cutting for splays, skewbacks, birdsmouths, &c.; cut or form chases for pipes.

Oversailings.

121. Oversail where possible to support the edges of concrete floors and projections, and to receive plates so as to avoid building them into walls.

Rake out and Point Flashings.

122. Rake out and point all flashings with cement.

Quoins.

123. The quoins throughout basement to be of hardest blue Staffordshire bull-nosed bricks.

Limewhite.

124. Twice limewhite the joists and underside of floor over cellar.

Strike the joints fair, and twice limewhite walls of cellar and vaults. Brush down, stop, and twice limewhite the walls and arch of old vault.

Cement Paving. *See Notes, p.* 417.

125. Pave with Portland cement paving $1\frac{1}{4}$ in. thick, floated and finished in pure cement, the wood house, servants' w.c., and kitchen yard.

If any part of the cement paving should prove defective during the stipulated time for maintenance, the *whole* of such paving in the apartment affected shall be taken up by the contractor and relaid at his own expense.

Blue-brick Paving.

126. Pave with best and hardest blue Staffordshire bricks, laid and grouted in cement, the coal-house, knife-house, and gardener's potting shed.

Tile Paving.

127. Pave with Edward's (Ruabon) 6 in. by 6 in. Adamantine Quarries, bedded and jointed in cement, the kitchen porch and the southern verandah.

Asphalte Paving.

128. Pave the whole of the basement with Limmer's Mastic asphalte, 1 in. thick, laid in two thicknesses, turned up 9 in. against all walls, and turned 1 in. into the joint of the brickwork at that level. This work to be done by the Limmer Asphalte Paving Company's own workmen.

Plate Safe.

129. Construct the plate safe of brickwork in cement. Turn vault over in firebricks as described, set in fire clay. Build in to every course of the brickwork of walls $1\frac{1}{4}$ in. by $\frac{1}{16}$ in. hoop iron lapped together at joints and angles, one line of iron to each half brick in thickness. Lay over the lower ring of the vault longitudinally lines of similar iron $4\frac{1}{2}$ in. apart. Face the walls with firebricks set in fire clay and neatly pointed. Form the bottom of a 4 in., rubbed one side, York stone landing, in one stone running through the whole thickness of the enclosing walls.

Form the doorway with rebated jambs, and 9 in. by 3 in. York rubbed lintel, 18 in. longer than the width of the opening.

Rebate the edge of the landing in the doorway.

Supply a safe door (P. C. £16 at the manufactory), cut and pin the lugs of frame to the brickwork, bed the frame in fire clay, and point it with cement.

Run around the inside of safe $\frac{3}{4}$ in. by 7 in. Portland cement trowelled skirting.

Stock Facings. 130. Face the detached offices with stocks selected from the general building bricks, raked out and neatly pointed with a weathered joint in cement.

Arches. 131. The arches in these facings to be of similar bricks in two half-brick rings, set in cement and pointed to match the facings.

Red facings. 132. Face the whole of the walls and chimney stacks of the main building with Brown's (Braintree) best red facing bricks laid Old English bond, and finished with a neatly struck bevelled joint as the work proceeds.

Moulded Bricks. *See Notes, p.* 421. 133. The moulded bricks to be of the usual stock patterns, and of perfect and true shape.

String Courses, &c. 134. The string courses and cornices shall be all headers, shall match the facing bricks, shall be set in cement, and raked out and pointed to match the general facing.

Plinth. 135. Form the plinth of one course of splayed bricks in cement, all headers and projecting 2¼ in.

Cornice. 136. The cornice at the first floor level shall be 12 in. high, cut, rubbed, and moulded to detail, of best red rubbers (Brown's), one course as dentils.

String Course at First Floor Level. 137. The string course immediately below the tile-hanging shall be three courses high, one course moulded, two courses plain, and all over-sailing.

Quoins. 138. The quoins to the buildings faced with stocks shall be of Brown's red bricks as before described, pointed to match the stock facing, and arranged as Fig. 4.

FIG. 4.

Panels. 139. The enriched panels shall be Brown's No. 450, pointed to match the facing.

Copings. 140. The brick copings shall be Brown's No. 317, set and pointed in cement.

Friezes. 141. The friezes shall be of Brown's best red rubbers, rubbed and gauged and set in fine putty.

Brickwork for Carving. 142. The brickwork in panels intended for carving shall be of Brown's best red rubbers, rubbed and gauged, set in shellac, and projecting 3 in. from the general face of the walls.

Corbels. 143. The corbels to pilasters shall be of Brown's best red rubbers, set in cement, cut, rubbed, gauged, and moulded to design.

Arches. *See Notes, p.* 421.

144. The arches to the north, east, and west fronts to be of Brown's best red rubbers, rubbed and gauged and set in putty; those to the south front to be axed.

Window Sills.

145. The window sills, where not described in stone, to be of two courses of best red splayed facing bricks on edge, all headers, with a double course of red plain tiles projecting 1½ in. from the face of the wall, and all set in cement.

Niche.

146. Construct the niche to detail, of best red rubbers, rubbed and gauged and set in putty. The impost and archivolt to be in similar bricks, moulded, the bottom and the moulding forming sill to be of similar bricks on edge.

Brick Internal Facings. *See Notes, p.* 421.

147. The salt-glazed bricks shall be of the best quality, dipped, picked for uniformity of colour, free from chips, cracks, and all other defects, the whole to be raked out and pointed at completion, with a neat joint, cut both edges in fine putty, gauged with Keene's cement.

The glazed bricks, other than salt-glazed, shall be of Cliff's best quality, free from cracks, chips, and all other defects.

All the salient angles of glazed brickwork to be bullnosed. Face with salt-glazed bricks the walls of the kitchen porch from floor to ceiling.

Glazed Tile Linings. *See Notes, p.* 422.

148. All the glazed tiles to be Minton's best quality, and free from all defects and blemishes, and set in Parian cement; all the salient angles to be finished with tile angle.

Line the walls of meat and game larders, for a height of 2 ft. above each shelf, with best ivory-white glazed tiles. Finish the salient angles with glazed tile angles to match. Run along the top and exposed ends of each piece of tiling a flash moulding 2 in. girth in Keene's cement.

Line the walls of bath-room with glazed tiles of the best quality of colour and arrangement as follows:—

Brown moulded skirting 6 in. high, celadon tiles for a height of 3 ft. above skirting, with ivory-white moulded capping 2 in. wide, and thence to cornice ivory-white tiles.

Tiling to Fireplaces.

149. Line the fireplaces where dog-stoves are specified with glazed tiling, P. C. 20*s*. per yard, set in Parian cement.

Lay the hearths of the same fireplaces, and those of bedrooms 1, 2, 3, and 4, with tiling, P. C. 20*s*. per yard, set in Portland cement.

Supply to each of these fireplaces a marble curb (P. C. 40*s*.), and set in Parian cement.

Provision of Material. 150. Provide to be used as directed, or deducted if not required :—

Three rods of brickwork in mortar.

One rod of brickwork in cement in small quantities and short lengths in underpinning.

MASON.—*See Notes, p.* 429.

Quality. 151. All stone to be of the best quality of its kind, free from vents, beds, sand or clay holes, threads, flaws, and all other imperfections, set on its natural bed, unless specially excepted, in fine mortar, cleaned down at completion, and left perfect.

Injury. 152. Any stone injured during the progress of the building shall be replaced, or the full cost of such stone deducted from the contract sum, at the option of the architect.

Stones to be Square. 153. Every stone to hold its full length and height square to the back.

Moulds. 154. The whole of the mouldings to be worked to zinc moulds.

Steps and Thresholds. 155. All steps and thresholds to be 9 in. longer than the openings, all steps and landings of staircases to be pinned into the walls adjoining at least $4\frac{1}{2}$ in. where there is a wall at each end ; elsewhere 6 in.

Jambs. 156. The jamb stones of doors and windows to extend from face of wall to face of frame, and from face of wall to back of frame alternately.

Work Stone on Site. 157. All the stone to be worked at the building.

Joints. 158. All joints of horizontal members, as sills, cornices, &c., to have double V joints run with cement.

Leadpads. 159. Lay in each bed of shafts of columns a sheet of 5 lbs. lead in one piece, $1\frac{1}{2}$ in. diameter less than that of the column.

Angles of Dressings to be Solid. 160. All the internal angles of stone dressings to be worked on solid.

Beds. 161. The beds of the stones are marked on the details Nos. 31, 32, 33, 34, 36, 54, and 60 ; they are the dimensions of the stones as they come to the banker.

Dowels. 162. The mullions and transomes to be dowelled together

with 1 in. by 1 in by 4 in. slate dowels, set in cement. Secure the finials to the apex stones by 1 in. by 1 in. by 12 in. copper dowels.

Corsehill Stone.

Quality. 163. The following works to be in Corsehill stone, from an approved quarry, finished with a finely rubbed face:—

The whole of the work tinted pale red on the elevations, or the particular works may be described as follows: The chimney shafts; the copings and finials of the gables with their adjuncts; the main cornice; the string courses; the plinth courses; the dressings of doors and windows; and the quoins.

Yorkshire Stone.—*See Notes, p.* 432.

Quality. 164. The Yorkshire stone to be Greenmoor from an approved quarry, and of the finest selected quality, the rubbing to be completed on the premises and the arrises left perfect.

Templates. *See Notes, p.* 432. 165. Put templates, tooled where exposed, of sizes and in positions as follows:—

9 in. by 9 in. by 3 in. to ends of ridges and purlins, and to bearer over first-floor landing.

14 in. by 9 in. by 3 in. to ends of iron girders over billiard room, to roof trusses over bedrooms 1 and 2.

18 in. by 12 in. by 6 in. the front edge of quadrant section, and projecting 4 in. to the shoes of iron roofs.

22 in. by 18 in. by 6 in., but with two edges as last described, to receive the shoes of iron roof on the dividing wall.

Cover Stone. 166. Lay over all iron joists supporting brickwork 3 in. tooled cover stone the whole width of the wall above, bedded and jointed with cement.

Corbelling. 167. Build in for the support of chimney-breasts and other projections 3 in. rough York.

Self-faced Core. 168. Supply core for cement cornice of 3 in. self-faced stone 21 in. wide set in cement, and roughly splayed on front edge.

Hearths. 169. The kitchen hearth and back hearth to be $2\frac{1}{2}$ in.

rubbed, 24 in. wide, and 24 in. longer than the width of opening.

170. The remainder of hearths (tinted blue on Plan) to be 2 in. rubbed, each slab to be 18 in. wide and 18 in. longer than the width of opening. The whole to have carefully jointed edges. The hearths tinted red are to be of tiles. (See "Bricklayer.")

Street Paving. 171. Take up, deposit, relay, and make good the street paving, or pay the local authority for the work.

Yard Paving. 172. Pave the yard with $2\frac{1}{2}$ in. tooled paving in parallel courses, laid to falls and bedded and jointed with cement. The whole to be carefully and truly jointed the whole depth of the stone, and no stone to be less than 10 ft. superficial.

Thresholds. 173. To all internal openings where tile paving occurs put 9 in. by 3 in. rubbed thresholds of width equal to the thickness of the walls.

Steps. 174. The steps to be rubbed on top and face and carefully back-jointed, and of the following sizes:—

9 in. by 6 in. to doorways next kitchen yard, and to garden entrance.

14 in. by 6 in. to trade entrance.

14 in. by 6 in., and 18 in. by 6 in., to principal entrance, the lower step to have quadrant ends.

Basement Stairs. 175. Construct the basement stairs of 11 in. by 6 in. steps, rubbed all round, the bottom step 11 in. by 6 in., with semicircular end, the whole to be pinned into wall 6 in.

Turret Stairs. 176. Construct the staircase in the turret of solid steps of spandril plan, $7\frac{1}{2}$ in. rise, with newel 6 in. diameter worked on each step, as Fig. 5, all bedded and jointed with cement, the whole of the exposed faces to be finely tooled. Insert at each bed of the newel 1 in. by 1 in. by 4 in. slate dowel in cement.

FIG. 5.

Basement Stairs. 177. Construct the stairs from kitchen corridor to basement of 2 in. treads and $2\frac{1}{4}$ in. risers, all bedded and jointed with cement. The bottom step to be solid, with semicircular end. The whole of the exposed faces to be finely tooled.

Curbs. 178. The curbs of pavement lights to be 6 in. by 4 in.,

rubbed on top and face, rebated 3 in. girth, and bedded and jointed in cement.

Copings. 179. Cope the parapets next yard and thence on northern party wall as far as chimney-shaft with 13 in. by 2½ in. tooled parallel coping, twice throated, and bedded and jointed with cement. The gable to have a solid apex stone 13 in. by 16 in. by 12 in.

Window Sills. 180. Put window sills 9 in. by 4 in., rubbed, sunk, weathered and throated, to window openings next yard and to basement windows.

14 in. by 4 in. to all the other windows.

All to be 4 in. longer than the width of opening, and grooved for iron tongues.

Bases. 181. Supply for each column and stanchion a 27 in. by 27 in. by 6 in. base of hardest stone, tooled all round, and with two mortises for stubs.

Chimney-piece. 182. Fix with iron cramps to the brickwork of kitchen fireplace 9 in. by 1½ in. rubbed and chamfered mantel and jambs. (For Wooden Shelf, see "Joiner.")

Portland Stone.

Quality. 183. The following works to be in the best brown Portland stone, finished with a finely rubbed face where exposed:—

Principal Stairs. 184. Construct the principal staircase of rubbed all round spandril steps, rebated and splayed, and with sunk and moulded fronts and returned moulded nosings of section, as Fig. 6, with square ends for building in. The bottom step to be solid, with bold curtail end, as shown on the Plan.

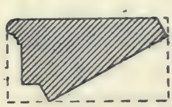

Fig. 6.

The landings to be 6 in. thick, with moulded nosings to match the steps, rebated to receive a splayed and splay-rebated riser, as Fig. 7.

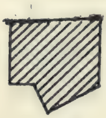

Fig. 7.

The joints of landings to be joggled on solid, and jointed with cement.

Paving of Hall. 185. Pave the inner hall with 2½ in. rubbed Portland stone, and 2½ in. rubbed blue Forest of Dean stone, in alternate squares, 12 in. by 12 in. square, and rub the joints for their whole depth, and bed and joint in cement.

Corbels to Pent Roof. 185A. Supply for each bracket of pent over tradesmen's entrance a rubbed corbel moulded to detail, and 12 in. by 6 in. by 6 in.

Granite Dressings. *See Notes, p. 434.* 185B. The granite shall be red Aberdeen from an approved quarry, of an even and uniform and approved tint, and free from all defects and equal to a polished sample to be deposited with the architect.

The backs shall be roughly axed, the beds and joints finely axed.

The joggles where necessary shall be V joggles. The exposed faces shall be highly polished. The whole shall be set in cement.

The following work shall be in granite as above described:—

The entablature, trusses, pilasters and their caps and bases. The part below the window with its skirting and the moulded capping thereto.

Spur Stones. 186. Supply for gateway two spur stones of Plymouth granite of the best quality, built into the piers 12 in. by 12 in. and 30 in. long in all, 12 in. above ground and 18 in. below, the part above ground finely axed, the part below roughly axed, and as Figs. 8 and 8A.

FIG. 8.

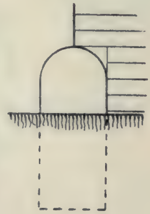

FIG. 8A.

Curb to Area. 187. Put curb to area of Plymouth granite 14 in. by 9 in. in not less than 4 ft. lengths, finely axed on exposed faces and twice splayed, 3 in. girth, bedded and jointed in cement.

Curb to Cartway. 188. Supply to cartway 12 in. by 8 in. curb, of approved Aberdeen granite, finely axed on all surfaces, including tho joints and bed, and joint it in cement. The corner blocks to be solid out of 17 in. by 17 in. by 12 in. circular both edges.

Paving of Gateway. 189. The paving to be of 3 in. by 5 in. Aberdeen granite setts, thoroughly and truly squared and selected so as to be free from damage by chipping. They shall be laid in regular courses, tightly driven together, and so laid and grouted as to be perfectly watertight. The whole to be grouted with the following mixture poured into the joints while boiling, $3\frac{1}{2}$ cwts. of pitch, 5 gallons of tar,

$\frac{1}{2}$ gallon of creosote oil, and 6 lbs. of plaster-of-Paris thoroughly mixed and well boiled.

MARBLE.—*See Notes, p.* 434.

Quality. 190. The marble shall be the best of its kind, free from stains, cracks, and all defects. Stopping will on no account be permitted. The polishing to be of the highest practicable finish. Protect the whole of the marble work by wooden casing until completion, and leave it perfect.

The steps and pavings to be sanded to a very smooth face, but not polished, all the other marble to be polished as described, all the joints to be rubbed and as close as possible.

Paving of Hall. 191. Pave the hall with 1 in. Kilkenny black marble and Sicilian marble in alternate squares 9 in. by 9 in. bedded and jointed in cement, the concrete to be floated with cement $\frac{3}{4}$ in. thick to receive it.

Steps between Hall and Vestibule. 192. Supply $1\frac{1}{2}$ in. Sicilian marble treads with moulded nosings and 1 in. risers in lengths of not less than 8 feet, and bed and joint with cement.

Lining of Walls of Vestibule. 193. Line the walls of the vestibule with Jaune antique (Numidian) marble in equal parallel courses about 15 in. high, fixed to the brickwork with copper cramps 2 in. by $\frac{1}{2}$ in. and 7 in. long, turned up and down at ends and about 18 in. apart in each bed. The skirting to be $1\frac{1}{2}$ in. similar marble, in lengths of not less than 5 ft. of height and moulding as detail. The cornice and frieze rail to be of wood. (See "Joiner.")

Principal Stairs. 194. Construct the principal staircase of solid Sicilian marble steps of spandril section as sketch, with sunk and moulded fronts, and returned moulded nosings. The bottom step to be solid, and that and the one above it to be segmental on plan.

The landings to be 6 in. thick with moulded nosings to match the steps, and rebated to receive a splayed and splay-rebated riser, as sketch.

The joints of landings to be joggled on solid and jointed with cement.

Lavatory Top, &c. 195. The lavatory tops to be of $1\frac{1}{4}$ in. Sicilian marble with moulded edges and elliptical holes for basins, each with a rounded edge. Form for each basin an oval sinking for

soap and brush respectively, with small perforation brass union and $\frac{1}{2}$ in. lead pipe as waste, carried into receiver.

Finish round the top with 12 in. by $\frac{3}{4}$ in. moulded skirting with moulded and returned ends and fixed with brass screws and cups to a deal ground.

WALLER.—*See Notes, p.* 428.

Rubble Stone. 196. The rubble stone to be obtained from Mr. Thompson's quarry about two miles from the building. It shall be free from flaws, sand or clay holes, and shall be selected for hardness.

Rubble Walling. 197. Build the walls with one course of footings 12 in. high and 4 in. projection on each side of large stones not less than 12 in. on face by the whole width of the course, all through stones, from thence up to the level of plates of ground floor build the walls solid in roughly dressed courses 4 in. to 6 in. deep with one through stone 14 in. on bed, to every superficial yard of wall.

Rubble Walling with Cavity. 198. From the underside of the plates of the ground floor to the top build the south, east, and west walls with similar walling 12 in. thick with a $\frac{3}{4}$ in. cavity and a $4\frac{1}{2}$ in. brick backing, tied to the stonework with galvanized wrought-iron ties, weight 60 lbs. per hundred, of approved pattern, placed 2 ft. apart in every sixth course of bricks.

Hygeian Rock filling to Cavity. 199. Fill in the hollow with White's Hygeian rock composition prepared and inserted exactly in accordance with the printed instructions of the patentee.

Build the north wall in a similar manner to that last described, but with a 2 in. cavity not filled in with composition.

Keep Cavity Clean. 200. Keep the cavity free from droppings of mortar or rubbish by hay bands, or movable boards. Leave openings at the level of the bottom of the hollow, and clear away any droppings that may have fallen, and fill up the openings afterwards.

Facing. 201. Face the whole of the walls with similar but selected stone, hammer dressed, with a rock face raked out and pointed with blue ash mortar.

Arches. 202. Turn, neatly hammer dressed relieving arches in

the facing about 10 in. deep and the whole thickness of the rubble over the stone lintels of openings and springing from the ends of the lintels.

Quoins. 203. Work a chisel draft 1 in. wide on each return of the quoins.

Flint Work. 204. Face the brick walls with approved knapped flints set in cement, with bands and quoins of red facing bricks, as shown in drawings, set in cement, and neatly pointed with a struck weathered joint as the work proceeds.

The arches to be axed segmental arches in similar facing bricks set in cement and pointed to match the facings.

Filling in Stone Panels 205. Fill in the stonework of ornamental panels with facing of black flints 3 in. by 3 in. accurately squared on beds, joints and face, set in cement with a close joint neatly pointed and accurately fitted to the free-stone work.

SLATER.—*See Notes, p.* 436.

Slating. 206. The slating to be of the best quality, free of spots and cracks, and the corners intact, the whole to be cut closely to hips, ridges, and vertical faces, and the eaves laid double.

Slating to Outhouses. 207. The slating to the wood shed, coal shed, and lamp room to be of Bangor Countess slates, 16 in. by 10 in., spaced 2 in. apart, laid to a $2\frac{1}{2}$ in. lap, and each slate nailed with two $1\frac{1}{4}$ in. composition nails.

Roof of Kitchen and Scullery. 208. Cover the roof of kitchen and scullery with Bangor Countess slates, 20 in. by 10 in., laid to a $2\frac{1}{2}$ in. lap, each slate nailed with two $1\frac{1}{4}$ in. copper nails; weight 7 lbs. per thousand.

Main Roof. 209. Cover the main roof with best green Westmoreland slating laid to a 3 in. lap, in courses diminishing from eaves to ridge, and each slate nailed with two $1\frac{1}{2}$ in. copper nails; weight $9\frac{1}{2}$ lbs. per thousand.

Roof of Turret. 210. Cover the roof of turret with similar slates to last. Neatly cut and mitre the hips, screw with copper screws, and bed in red lead cement.

Verges. 211. Where there are no gable parapets the verges of the Countess slating shall be laid double and bedded in cement.

212. For the Westmoreland slating the verges shall be laid double and bedded in cement, and shall have in addition a course of slates in cement as soffite, and cement hollow fillet, as Fig. 9.

FIG. 9.

Slate Ridge. 213. The ridge to wood shed, coal shed, &c., shall be a 2 in. rubbed slate birdsmouthed roll and $5\frac{1}{4}$ in. by $\frac{1}{2}$ in. sawn slate wings, bedded and jointed in oil cement, and screwed with copper screws.

Tile Ridge. 214. The ridge of main roof shall be Cooper's (Maidenhead) No. 15 red ridge tile, bedded and jointed in cement.

Hip Knobs. 215. Fix in cement at the apex of each hip of main roof Edwards's (Ruabon) No. 12 finial.

Torching. 216. Torch the inside of slating over cistern rooms with lime and hair mortar.

Circular Turret. 217. Cover the roof of the circular turret at the south-eastern angle of the main roof with the smallest sizes of the Westmoreland slating, laid as described for the main roof.

Glass Slates. 218. Fix in roof over cistern room 12 glass slates of $\frac{1}{2}$ in. rough plate, each screwed with two copper screws.

Vertical Slating. 219. Cover the whole of the south wall of the main building between the string course at the first floor level and the eaves of the roof with Bangor Countess slating, 20 in. by 10 in., to a $2\frac{1}{2}$ in. lap, each slate nailed with two $1\frac{1}{4}$ in. copper nails to $2\frac{1}{2}$ in. by 1 in. battens secured to plugs in the brickwork. Neatly and closely cut and mitre the external and internal angles and bed them in cement. The eaves to be laid double and bedded in cement. Render and trowel in Portland cement the reveals of the windows occurring in this slating.

Leave Perfect. 220. Clean out gutters and leave all roofs and vertical slating clean, perfect, and weatherproof at completion.

Or,

Stone Slates. Cover the whole of the roofs with stone slating of the best quality from Finch's quarries (Barton, near Winchcomb, Gloucestershire) in promiscuous sizes, laid diminishing from eaves to ridge, bedded in lime and hair to a 3 in. lap, and each slate nailed with two 2 in. galvanized steel nails to $1\frac{1}{4}$ in. by $1\frac{1}{2}$ in.

Stone Slates. sawn deal laths, all cut close to ridges and vertical faces, and the eaves laid double.

Lay the verges double where there is no gable parapet, and bed and point with cement.

Neatly and closely cut and mitre the hips and bed them in cement.

Finish the ridges with best Taynton stone sawn ridge out of 8 in. by 8 in. stone, and $1\frac{1}{4}$ in. thick, as Fig. 10, in 2 ft. lengths, the junctions of ridge to be solid, 18 in. by 18 in., and the hipped ends to ridges also solid and 18 in. long, all to be bedded and jointed in cement.

Fig. 10.

Leave Perfect. Clean out gutters and leave all roofs clean, perfect, and weatherproof at completion.

SLATE MASON.—*See Notes, p.* 438.

Larder Shelves. 221. The slate to be best sawn Valentia slate, free from spots, stains, vents, and all other defects.

Fix in larder two tiers of 1 in. sawn slate, rubbed and sanded both sides, shelves 24 in. wide, with rubbed edges, and not less than 6 ft. lengths, pinned into the walls not less than 2 in., the joints rebated and set in oil cement, and the corners rounded.

Support these shelves by 2 in. rubbed, sanded, and diminished cantilevers about 5 ft. apart, 2 ft. 9 in. long, and $4\frac{1}{2}$ in. wide, pinned into the walls and shaped to design.

Lavatory Top 222. Supply lavatory top of $1\frac{1}{4}$ in. sawn slate, rubbed and sanded both sides, in one length, the front edge rounded and pinned into wall 2 in. at back and at ends. Cut three circular holes for basins, the edges rubbed and rounded. Further support the top by two cast-iron galvanized lavatory brackets (Bolding & Sons, No. 420), the lugs pinned into the brickwork. Finish at back with 6 in. by $\frac{3}{4}$ in. chamfered skirting, with shaped and chamfered ends, fixed with brass screws and cups to plugs in wall.

Slate Cistern. 223. Supply cisterns in scullery of 1 in. sawn and rubbed Bangor slate, 5 ft. by 3 ft. and 2 ft. 6 in. deep (all in clear), rebated and grooved together in red lead cement, and secured

by six $\frac{1}{2}$ in. galvanized iron bolts, with heads, nuts, and washers. Cut holes for supplies and wastes.

Cantilevers. 224. Support the shelf of kitchen chimney-piece by two cantilevers of rubbed slate 2 in. by 5 in. by 15 in., twice chamfered, shaped, and diminished, pinned into brickwork, and the stone mantel notched to receive them. Cut mortises in these cantilevers, and run with lead as plugs to receive screws for attachment of wooden shelf.

Mat Sinkings. 225. Form mat sinkings of the size shown in the tiled floors, with 3 in. by 2 in. rubbed slate, fillet as border; the tile floor to be omitted in these sinkings, and the space rendered, floated, and trowelled in Portland cement 1 in. thick.

TILER.—*See Notes, p.* 439.

Tiling. 226. Cover the roofs, including pent roof over tradesman's entrance, with tiles of true shape and even colour, free from fire-cracks and other defects, of Edwards's (Ruabon) best quality, laid to a 4 in. gauge in a small quantity of lime and hair (just sufficient to bed them), fixed with stout galvanized wrought-iron pins with broad heads, on $\frac{3}{4}$ in. by $1\frac{1}{2}$ in. strong sawn fir laths, all to be cut closely to hips, ridges, and vertical faces, and the eaves laid double.

Tile and Half. 227. Put to all verges, hips, and valleys tile and half, to break joint.

Verges. 228. Bed all verge tiles in cement, and render in cement.

Hips and Valleys. 229. Put to all hips and valleys purpose-made hip and valley tiles, to course and bond with the general tiling.

Ridges. 230. Finish the ridges with Cooper's (Maidenhead) No. — tile ridge, and bed and joint with cement. Finish the apex of each hip with Johnson's (Ditchling) No. — tile, finial bedded and jointed with cement.

Leave Perfect. 231. Clean out gutters, and leave all roofs clean, perfect, and weatherproof at completion.

CARPENTER.—*See Notes, p.* 441.

Quality. 232. The whole of the timber to be perfectly sound and well seasoned, free from sap wood, large, loose, or decayed knots, wany edges, and all other defects, sawn die square, and no outside slabs to be used.

Fir. 233. The fir to be Crown Memel or best red Riga; or the timbers of carcasing may be of deals or battens, K.H.B. brand (or any other brand you may prefer).

Teak. 234. The teak to be the best Moulmein, well seasoned, free from shakes and all defects.

Oak. 235. The oak to be the best English, dry, sound, well seasoned, felled at least five years, and out of large trees.

Scantlings. 236. All the timber to be cut into scantlings immediately after signing of contract, and to be framed as long as possible before fixing.

Trimmers. 237. All trimmers to be half an inch (or an inch) thicker than the common timbers (or their size may be regulated by the number of timbers framed into them).

Distances. 238. No joist rafters or quarters to be more than 12 in. apart, all the principal timbers, wherever possible, to have a bearing of not less than 9 in. on the wall at each end.

Lintels. 239. To all openings requiring lintels, put lintels 1 in. in depth for every foot of bearing, but none less than 3 in. thick and 9 in. longer than the width of opening.

Pads or Palettes. 240. To all openings finished with joinery put ½ in. by 4½ in. deal pads built into the brickwork as wood bricks, none to be less than 9 in. long, or more than 2 ft. apart.

Centering. 241. Supply all necessary centering for arches, &c., none to be removed until directed.

Fillet Soffits. 242. Fillet soffits of trimmers for lathing to.

Bracketing, &c. 243. Do all necessary bracketing and cradling.

Dowels. 244. All frames to be dowelled to stone steps with wrought-iron dowels.

Finished Sizes. 245. If finished sizes are required.

The whole of the specified or figured dimensions of timbers to be the finished sizes when fixed in the building.

Notching and Cogging. 246. Slightly notch the rafters to the purlins, and the bridging joists to the binders.

Wrought Faces. 247. The faces of all exposed timbers to be wrought.

Scarfing. 248. Where timbers are scarfed they shall overlap for a length equal to four times their depth, and shall be bolted by ½ in. bolts, fixed vertically, and about 18 in. apart.

Cleats. 249. To all purlins, where they lie on roof trusses, put fir splayed cleats 9 in. by 6 in. by 6 in. securely spiked.

Roof of Main Building. *See Notes, p.* 449. 250. Construct the roof over the main building with trusses of tie beams 9 in. by 3 in., principal rafters 5½ in.

Roof of Main Building. by 3 in., king posts out of 7 in. by 3 in., struts 4 in. by 3 in. Secure each king post at foot by a $\frac{3}{4}$ in. bolt 18 in. long with a hand-rail nut. Each principal rafter at foot by a $\frac{3}{4}$ in. bolt, 15 in. long.

Construct the half principals at ends (at right angle to those last described) with similar tie beams, principal rafters, and struts, a half king post out of 5 in. by 3 in., spiked to the adjoining king post. The end of the tie beam of the half principal to be framed to the tie beam of the truss adjacent, and further secured by two 2 in. by $\frac{1}{2}$ in. straps, 24 in. long, bolted with $\frac{3}{4}$ in. bolts, six in all, as Fig. 11.

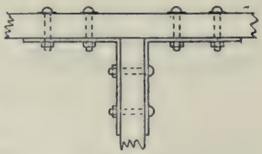

FIG. 11.

The purlins to be 8 in. by 5 in., strutted where necessary with 4 in. by 4 in. struts.

The plates to be $4\frac{1}{2}$ in. by 3 in., ridge 9 in. by 2 in., the shorter valleys 7 in. by 2 in., the longer 9 in. by $2\frac{1}{4}$ in., rafters 4 in. by $2\frac{1}{4}$ in. Cover with 1 in. rough boarding for slating.

Roofs Generally. 251. The remainder of roofs to have plates $4\frac{1}{2}$ in. by 3 in., rafters 4 in. by $2\frac{1}{4}$ in., purlins 6 in. by 4 in., ridges 9 in. by $1\frac{1}{2}$ in. Cover with 1 in. rough boarding as before.

Sprockets. 252. At the foot of each rafter put a sprocket 18 in. by 4 in. by $2\frac{1}{2}$ in.

Rafter's Feet. 253. The projecting parts of rafters to be wrought, and the ends shaped to detail.

Eaves. 254. To all eaves put 4 in. by 2 in. splayed eaves fillet.

Fascias. 255. Put to all eaves 5 in. by $\frac{3}{4}$ in. wrought and beaded fascia.

Tilting Fillets. 256. To all valleys and up slopes of roofs adjoining vertical faces put deal tilting fillets.

Boarding and Felt. 257. Cover the whole of the roofs with 1 in. rough boarding and stout inodorous felt, lapped and nailed with clout-nails.

Where the eaves project, substitute for the rough boarding 1 in. wrought one side matched and beaded boarding in $4\frac{1}{2}$ in. widths.

Slating Battens. 258. Nail to the boarding of all roofs described to be slated $2\frac{1}{2}$ in. by $\frac{3}{4}$ in. slating battens.

Gutters. 259. Lay the gutters with $1\frac{1}{4}$ in. gutter boards and

bearers to a fall of $1\frac{1}{2}$ in. in 10 ft., with 2 in. cross-rebated drips not more than 10 ft. apart, and 2 in. rounded rolls where required. The gutters shall not be less than 10 in. wide in the narrowest part.

Construct similar gutters of an average width of 6 in. behind skylights and chimney shafts, and in similar positions.

Cesspools. 260. Form cesspools where required, generally about 10 in. by 10 in. and 6 in. deep, all in clear, dovetailed, holed, and fitted.

Barge Boards and Finials. 261. Put to gables 2 in. wrought and twice ovolo-moulded barge-boards, with shaped and moulded ends, and framed at apex into a 5 in. by 5 in. fir finial, cut and moulded to detail. Prolong the plates, ridges, and purlins as fixing for barge board.

Snow Boards. 262. Lay over the gutter between bedrooms 8 and 9, deal wrought snow boards of $2\frac{1}{4}$ in. by $1\frac{1}{2}$ in. laths, about 1 in. apart, on $3\frac{1}{2}$ by 2 in. cut and shaped bearers about 3 ft. apart, the whole made in convenient lengths for removal.

Ways in Roof. 263. Lay above the ceiling joists where directed 1 in. rough boarding as ways, provide 300 ft. superficial for this.

Ceiling Joists. 264. The ceiling joists to be $3\frac{1}{2}$ in. by $2\frac{1}{4}$ in., with 5 in. by 3 in. stretchers, and 4 in. by 3 in. hangers where required, the latter about 4 ft. apart.

Flat over Scullery. 265. Construct the flat of joists 7 in. by $2\frac{1}{2}$ in., cover with 1 in. rough boarding, traversed to receive lead, and firred up to give a fall of $1\frac{1}{2}$ in. in 10 feet, 2 in. rolls about 2 ft. 6 in. apart, and 2 in. cross-rebated drips about 10 ft. apart. Form gutter with $1\frac{1}{4}$ in. gutter boards, 2 in. drips, and cesspools as before.

Flat over Boot-room. 266. Construct the flat over boot-room in all respects as last described, but with 2 in. by 2 in. twice-splayed rolls to receive zinc.

Dormer. 267. Construct the dormer of box-roof (eastern front) of ridge $1\frac{1}{4}$ in. by 7 in.; valleys, 7 in. by 2 in.; rafters, $4\frac{1}{2}$ in. by 2 in.; ceiling joists, $4\frac{1}{2}$ in. by 2 in.; cover with 1 in. boarding, and felt as described to main roof.

The cheeks to be of 1 in. rough boarding and small fir framed quarters.

Frame the front of oak sill 6 in. by 3 in., double-sunk, weathered, throated and check-throated, 5 in. by 5 in. fir

Dormer. posts, rebated, narrow chamfered and ovolo moulded, 5 in. by 4 in. in head. Fix beneath verge of tiling beneath eaves and on head 4 in. by $2\frac{1}{2}$ in. in deal moulding, the angles tongued, mitred, and screwed. Fill in the tympanum of gable with $1\frac{1}{4}$ in. deal. The casement to be 2 in. moulded, hung with $2\frac{1}{2}$ in. iron butts. Groove the edges of casement and the frame adjoining to form water-hollow, Splay, rebate and groove the bottom rail of casement. Fit with 9 in. japanned iron casement stay and japanned iron cockspur fastening. Finish inside with 1 in. by 3 in. twice-chamfered architrave and $1\frac{1}{4}$ in. rebated and twice-chamfered window nosing.

Skylights. 268. Trim the roof for skylight. Supply 2 in. deal moulded skylight, throated all around with moulded bars, and screwed with brass screws to 2 in. deal curb, dovetailed at angles. Finish inside with 1 in. wrought and staff beaded lining, tongued at angles ; finish around the linings immediately below the skylight, with 2 in. by 2 in. deal bed moulding.

Lantern. 269. Construct the lantern over laundry of 7 in. by 4 in. oak sill, sunk, weathered, throated and check-throated, and the lower edge beaded, secured to the deal curb by 6 in. joint screws 4 feet apart. The head of front to be $4\frac{1}{2}$ in. by 4 in. deal rebated, and the upper edge splayed, and with dovetailed halved and screwed joints. Mullions, $4\frac{1}{2}$ in. by 3 in. The casement to be 2 in. moulded, with large moulded bars, one casement in each bay, hung on $3\frac{1}{2}$ in. iron centres, and opened by Elsley's gear, for which a sum is provided (see Provisions), the remainder to be fixed. Splay, rebate and groove the bottom rails at all casements. The opening casements to be grooved on three edges, and the frame similarly grooved to form water-hollow. Finish around each casement, inside and out, with beads, fixed with brass cups and screws. Cut as required for the opening casements. The ridge to be 7 in. by 2 in., with 2 in. roll birdsmouthed on. The skylights to be $2\frac{1}{2}$ in., moulded with large bars with stiles 4 in. wide at intervals, and fixed with stout brass screws to the head and ridge, the lower edges throated. Fix to inside of head 2 in. condensation gutter, with $\frac{1}{2}$ in. outlets soldered in, passing through head, all in stout zinc.

Lantern over Billiard Room in Pitch-pine. 270. Construct the lantern over billiard room as follows: Fit on each side of the steel joists supporting the curb 9 in. by $2\frac{1}{2}$ in. fir flitches, framed at the angles. Bolt through steel and wooden flitches with $\frac{1}{2}$ in. bolts 24 in. apart, the heads and nuts let in flush. Fix on the top of the steel joists and bolt to the top flange with $\frac{3}{4}$ in. coach bolts, 24 in. apart, a deal curb 11 in. by 4 in., frame the angles, and put outside of each a $\frac{1}{2}$ in. by 2 in. wrought-iron strap, 18 in. long, bolted with four $\frac{1}{2}$ in. coach bolts.

Oak sill, 6 in. by $3\frac{1}{2}$ in., double sunk, weathered, throated and checked throated, the angles mitred and framed, secured at the angles with 9 in. joint screws. Bolt this sill down to the curb with 6 in. No. 32 screws, about 18 in. apart, the heads let in and covered.

All the work above the oak sill to be of pitch pine angle posts 5 in. by 5 in., twice rebated, twice ovolo moulded. The salient angles outside to be staff beaded 2 in. girths, the corresponding angle inside the lantern to be moulded 3 in. girth. The mullions 5 in. by 4 in. four times ovolo moulded. The head 5 in. by 4 in. rebated, twice ovolo moulded, and the upper edge splayed. The casements to be 2 in. moulded in single squares. Fit all around on both sides with 1 in. by $\frac{3}{4}$ in. mouldings, screwed with brass screws and cups. The alternate casements to be hung on 3 in. brass centres with steel bushes, and the mouldings cut to allow the casements to swing.

Supply to each side and end of the lantern Hills' (100A, Queen Victoria Street) patent continuous gearing, with screws and rods, all of gunmetal, with special wheels and pulleys on ceiling, and best superfine flax lines, to work from outer walls, with ornamental brass cleats. P. C. 2*s*. each.

Construct the hipped roof of ridge and hips 7 in. by $2\frac{1}{2}$ in., twice ovolo moulded. The bars to be $2\frac{1}{2}$ in. by 2 in. moulded, and about 15 in. apart. Fix to the upper edge of head with copper nails, and immediately under the glass, a strip of $\frac{1}{4}$ in. boiler felt 4 in. wide.

Fix at the level of head a 3 in. by 2 in. moulding as cornice. Line the well of the lantern below the sill with $1\frac{1}{4}$ in. moulded framing one panel high, the lower edge kept below the ceiling twice ovolo moulded, grooved for the

plastering. Tongue to the inside of the oak sill $2\frac{1}{2}$ in. by 2 in. moulding, as capping to framing last described.

Finish the ridge and hips with a 2 in. deal rounded and birdsmouthed roll.

The whole of this lantern and skylight to be framed and put together in white lead.

Pent Roof over Tradesmen's Entrance.

270A. Construct the pent roof (Fig. 12) over tradesmen's entrance of wall plate $4\frac{1}{2}$ in. by 3 in., lower plate 4 in. by 4 in., rafters $4\frac{1}{2}$ in. by $2\frac{1}{2}$ in.

Construct the brackets to detail of wall pieces and horizontal pieces 4 in. by 4 in., struts out of 11 in. by 4 in., framed in the best manner and pinned with oak pins. Shape the ends of the horizontal pieces of the brackets and the lower plate, twice ovolo mould the members of brackets and the lower plate. Work all the exposed faces of the timbers. Mould the ends of the rafters.

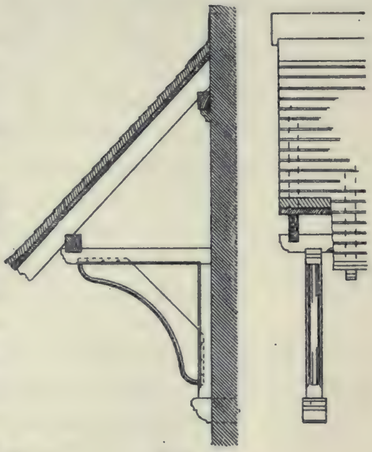
FIG. 12.

Cover with $1\frac{1}{4}$ in., wrought one side, V-jointed, grooved and tongued boarding in 4 in. widths. Finish eaves with 4 in. by $1\frac{1}{2}$ in. feather-edged eaves fillet.

Secure each bracket to the wall by two $\frac{3}{4}$ in. wrought-iron bolts passing through the wall piece one end, caulked the other with screw and nut let in and covered.

For Tiling, see "Tiler"; for Corbels, see "Mason."

Trap.

271. Trim the main roof for traps as access to central gutter, supply $1\frac{1}{2}$ in. wrought one side curb, 11 in. wide, fixed on back of rafters 2 ft. 3 in. by 2 ft. 3 in. in clear, and $1\frac{1}{4}$ in. wrought and cross-tongued trap, with $1\frac{1}{4}$ in. rims, dovetailed at angles and screwed on. Fit with two 4 in. iron necked bolts.

Turret over Riding School.

272. Construct the turret over riding school of horizontal bearers 6 in. by 4 in., extending from purlin to purlin, and bolted thereto with $\frac{3}{4}$ in. bolts 15 in. long, the angle posts

Turret over Riding School. to be 4 in. by 4 in., bolted at bottom to the bearers last described with 1 in. bolts 18 in. long, with handrail nuts. The sill and head (above and below louvres) to be 4 in. by 4 in., splayed both edges and framed into the angle posts, two 4 in. by 3 in. horizontal struts, framed into head, passing across the turret, the centre post to be 4 in. by 4 in. and 3 ft. 6 in. long (the hips framed into it), and turned for a length of 15 in. as finial. The hips to be $2\frac{1}{2}$ in. thick, the outer edge cut to ogee curve of cupola, eight $2\frac{1}{4}$ in. rafters framed into the hips and similarly cut. Form a base to the finial with a turned ring of moulding 3 in. by 3 in. rebated on inner edge and let into a groove of the centre post. Cover the cupola with $\frac{3}{4}$ in. rough boarding in $3\frac{1}{2}$ in. widths bent to the curves, laid diagonally, and prepared to receive lead; finish head (at base of cupola) and sill below louvres with 4 in. by 3 in. moulding splayed on back edge, and the angles tongued, mitred, and screwed, cover the part below louvres with 1 in. rough boarding to receive lead; finish the soffit inside above louvres with 1 in. grooved tongued and beaded boarding in 4 in. widths. Line the inside of the part below louvres with similar boarding, the exposed edges staff-beaded. Frame into posts and heads of louvred openings 2 in. deal cusped heads. Each opening to have four $1\frac{1}{4}$ in. by 7 in. wrought louvres splayed both edges and housed at ends.

Or,

Construct the turret over riding school of fir and deal, in accordance with detail No. 52.

Quarter Partitions. 273. Construct the quarter partitions of heads, sills, and braces $4\frac{1}{2}$ in. by 3 in.; posts, $4\frac{1}{2}$ in. by 4 in.; quarters, $4\frac{1}{2}$ in. by $2\frac{1}{4}$ in.

Where the partitions run in the same direction as the joists, support them by 4 in. by 3 in. bridging pieces, about 3 ft. apart, framed at each end between the joists.

The partitions, where trussed, to be framed to a detail to be supplied.

Or,

* Construct trussed partitions between bedrooms No. 7 and No. 8, framed as Fig. 13, and of scantlings, as

follows:—Sill and intertie, 7 in. by $4\frac{1}{2}$ in.; head, 5 in. by $4\frac{1}{2}$ in.; posts and struts, 4 in. by $4\frac{1}{2}$ in.; doorposts, 6 in. by $4\frac{1}{2}$ in., each cut with a shoulder to receive strut; bolt both ends of each strut over intertie with a $\frac{3}{4}$ in. bolt; put similar bolt at foot of the strut at each side of the doorway; prolong the ends of head sill, and intertie 9 in. at each end, to rest on templates in the wall; bolt the foot of each doorpost to the sill with a $\frac{3}{4}$ in. bolt, 18 in. long, with handrail nut.

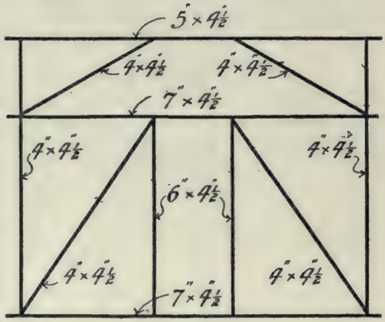

FIG. 13.

Bressummers. 274. The bressummers over openings into bays to be of three 9 in. by 3 in. deals, and two 9 in. by $\frac{1}{2}$ in. wrought-iron flitches, the whole bolted together with $\frac{1}{2}$ in. bolts, 18 in. apart.

FLOORS.—*See Notes, p.* 451.

Ground Floor. 275. The ground floor to have plates $4\frac{1}{2}$ in. by 3 in.; joists, $4\frac{1}{2}$ in. by 3 in.

First Floor. The first floor to have plates $4\frac{1}{2}$ in. by 3 in.; joists, 9 in. by $2\frac{1}{2}$ in. to rooms 7, 8, and 9. Joists 11 in. by 3 in. to the remainder of the rooms, except ballroom.

Fit to the iron joists over kitchen plates $4\frac{1}{2}$ in. by 3 in., bolted with $\frac{1}{2}$ in. bolts about 30 in. apart.

Construct the floor of ballroom of plates $4\frac{1}{2}$ in. by 3 in. on the walls, and similar plates on each side of the steel girders (see "Smith"), bolted through girder and the two plates with $\frac{1}{2}$ in. bolts, 2 ft. apart. Binders to be 11 in. by 9 in., placed 7 ft. apart. Bridging joists 7 in. by $2\frac{1}{2}$ in.; ceiling joists beneath, 3 in. by $2\frac{1}{4}$ in.

Second Floor. The second floor to have plates $4\frac{1}{2}$ in. by 3 in.; joists, 7 in. by $2\frac{1}{2}$ in. to cistern room and boxroom. Joists 9 in. by 3 in. to the remainder of this floor.

Sound Boarding. 276. Put to the whole of the first floor $\frac{3}{4}$ in. sound boarding on stout deal fillets.

Herring-bone Strutting. 277. To joists of upper floors, except to ballroom, put rows of stout herring-bone strutting 5 ft. apart, carefully fitted and securely nailed to the joists.

Half Timbering where Plastered only. 278. Construct those parts of the external enclosure of first floor which are shown on elevations to be half timbered of sill 12 in. by 6 in., head 9 in. by 6 in., intertie 6 in. by 6 in., corner posts 6 in. by 6 in., curved braces 6 in. thick, and of elevation as shown on detail. The timbers to be left with a sawn face, and the whole to be accurately framed and pinned with 1 in. diameter oak pins, projecting $\frac{3}{4}$ in. from the face. The salient angles of the horizontal members to be secretly framed, and to have inside the angle an angle strap 2 in. by $\frac{1}{2}$ in., and 24 in. long, bolted with four 6 in. by $\frac{3}{4}$ in. coach bolts. The edges of the timbers next the plaster panels to be slightly chamfered and V grooved. Nail to the edges of the timbers 2 in. by 2 in. rough fillets, to receive the lathing. Nail on the back of these fillets 2 ply B. 1·120 Willesden paper.

Half Timbering with Brick Filling. 279. The half timbering of south front to be all as last, but to be filled in with brickwork of Lawrence's best red facing bricks, set and pointed with a neatly cut weathered joint in cement, all carefully and neatly fitted to the timber, the backing to be of brickwork in cement.

Fences. 280. Enclose the wood yard with an oak fence 6 ft. high, of 6 in. by 6 in. sawn posts, 7 ft. apart, with substantial charred butts, 30 in. in the ground, three 4 in. by 3 in. sawn arris rails, and stout cleft pales nailed with galvanized iron nails and two rows of No. 16 B. W. G. galvanized hoop iron, and $1\frac{1}{4}$ in. by 9 in. sawn gravel plank.

Stop-rebate two of the posts, and supply a gate the height of fence, and 2 ft. 6 in. wide, of $1\frac{1}{2}$ in. oak-framed and ledged frame four panels high covered with cleft pales to match the fence. Hang with 4 in. iron butts. Fit with strong Norfolk thumb latch.

Provision of Material. 281. Provide 50 ft. cube of fir framed in roofs, to be used as directed, or deducted if not required. Provide 5 cwt. of wrought iron in straps and bolts to roofs, and fixing, to be used as directed, or deducted if not required.

JOINER.—*See Notes, p. 454.*

Materials. 282. The whole of the materials for joiner's work to be thoroughly well seasoned, free from sap-wood, large, loose, or decayed knots, wany edges, and all other defects.

Deal. *See Notes, p. 443.* 283. The deals for framings to be the best red St. Petersburg or Onega (or Gromoff's first quality, or equal thereto), the whole to be carefully faced up for paint, or to be selected deal, kept clean for staining, finished with the plane, without sand-paper.

Wainscot. *See Notes, p. 474.* 284. The wainscot oak to be the best Memel, of good figure, and cut "on the quarter."

Mahogany. *See Notes, p. 476.* 285. The mahogany generally to be the best Tabasco, of good figure, free from all defects, and kept clean for polishing. The Spanish mahogany to be of the finest selected quality, and of handsome figure.

Teak. *See Notes, p. 477.* 286. The teak to be the best Moulmein, free from shakes and all other defects.

Pitch Pine. *See Notes, p. 447.* 287. The pitch pine to be from Savannah, of the best selected quality, of good figure, finished with the plane, without sand-paper, and kept clean for varnishing.

Glued Joints. 288. All glued joints are to be cross-tongued.

Secret Fixing. 289. All the wainscot and mahogany work to be secretly fixed.

Sometimes with brass slotted plates and brass screws.

Finished Sizes. 290. The dimensions and thicknesses figured on the drawings, or described in this specification, to be the finished sizes when fixed in the building.

Drying and Priming. 291. The joiner's work, within a month of signing contract, is to be put together without wedging and kept in a drying-room until required for use. No joinery to be primed until it has been inspected and approved by the architect.

Sawdust. 292. The floors shall all be laid straight, joint with splayed headings and mitred borders to hearths, punched, puttied, traversed, and cleaned off at completion, and after laying until completion of works, shall be thickly covered with dry sawdust.

Linings. 293. All linings to be tongued at angles, and tongued to frames where there are frames.

Narrow Chamfer. 293A. The edges of all doors and opening casements to have a narrow chamfer, with a corresponding narrow chamfer on the frame or lining adjoining to form a V joint.

Iron Dowels. 294. All solid frames to be dowelled to the stone steps with $\frac{3}{4}$ in. by $\frac{3}{4}$ in. iron dowels.

Floors, &c., over Pipes and Bell-wires. 295. The whole of the boarding and joinery over pipes and bell-wires to be fixed with brass cups and screws to remove. Sometimes the following: If the joints of the flooring open $\frac{1}{16}$ in. before the payment of the final balance, the whole of the flooring of the apartment in question shall be taken up and relaid at the contractor's expense.

Pipe Casing. 296. To all chases for pipes put 1 in. rebated and beaded grounds, and $\frac{3}{4}$ in. pipe casing fitted to remove, and screwed with brass cups and screws. The wood shall match the wood of the fittings adjacent.

Support Lead Pipes. 297. Lead pipes other than vertical shall be fixed to 3 in. by 2 in. chamfered fillets plugged to the walls.

Bottom Rails of Sashes. 298. The bottom rails of all sashes and casements to be splay-rebated and grooved.

Meeting Rails of Sashes. 299. The meeting rails of all sashes to be splay-rebated.

Deep Beads to Windows. 300. The inside beads on the sills of all deal-cased frames shall be $2\frac{1}{2}$ in. wide for ventilation.

Blind Boxes. 301. Form blind boxes to all deal-cased frames by widening the inside lining of the head, inserting a $\frac{3}{4}$ in. moulded fascia and soffit, tongued together with 1 in. shaped brackets at ends, and the architrave carried around, as Fig. 14.

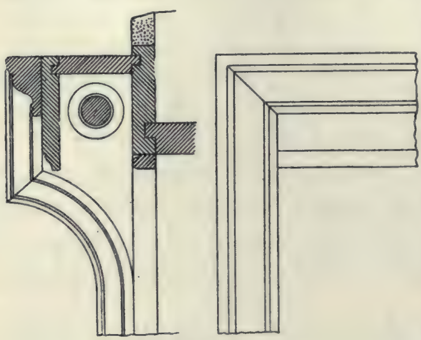

FIG. 14.

Iron Tongues. 302. Where the oak sills rest on brick or stone window sills, insert $1\frac{1}{4}$ in. by $\frac{1}{8}$ in. galvanized-iron tongue, let into grooves of wood or stone, and bedded in white lead.

Canvassing. 303. The window backs shall have thick canvas glued to

the face of the framing next the wall, and shall be painted with two coats of red lead and oil.

Dovetailed Backings.

304. When door linings are 11 in. wide, or over, they shall have dovetailed backings.

Architrave Bases.

305. All the architraves except the twice-chamfered ones to have moulded bases $\frac{1}{4}$ in. wider and $\frac{1}{8}$ in. thicker than the architrave, which shall be dovetailed and screwed to the base.

Oak Work.
See Notes, p. 473.

306. The oak joinery to have double tenons to all framings where the thickness exceeds $1\frac{1}{4}$ in. All oak window backs, dados, and similar framings, are to have the mouldings screwed from the back. All oak doors are to have the mouldings framed and screwed together at the angles let into the stiles and rails, well glued in, and fixed without nails or screws. Put to the vertical edges of all hard-wood doors for their whole height a $\frac{3}{4}$ in. fillet let in and glued. The whole to be fumigated to an approved tint.

Sashes and Frames.
See Notes, p. 464.

307. All sashes and frames to have moulded horns to both top and bottom sashes, the moulding and rebate to be stopped so that the horn may be of the full size of the stile.

The casements marked X on the elevations shall be fitted to open.

The inside beads of all deal-cased frames and casements to be screwed with brass screws and cups.

Grounds.

308. All joinery to be fixed to grounds. The grounds to be wrought and framed, and the edges adjoining plastering to be splayed.

The grounds to be 1 in. by 3 in., and where adjoining flues, to be fixed with wall-hooks.

Ironmongery.
See Notes, p. 457.

309. All ironmongery to be of the best quality and town manufacture, and fixed with screws; the brasswork with brass screws.

The locks and latches, unless otherwise described, to be Hobbs's machine-made fine finish.

The whole of the locks to be under one mastership, with three master-keys to pass.

For hotels, public baths, &c., sub-master keys to pass certain sections of the building. Hobbs, Hart & Co.'s

Ironmongery. trade list describes the various arrangements which are possible.

All the lock and latch furniture to be Pitt's patent, of the strongest description.

Or,

> The whole of the ironmongery, except butts and brass cups and screws, to be supplied and delivered by Messrs. . A sum is provided (see Provisions). Contractor to fix all ironmongery.

All iron butts to be wrought.

Adjust the swing hinges at completion, and fill the boxes with glycerine.

Iron Cramps. 310. Fix the frames of external doors to the brickwork with wrought-iron cramps, not more than 2 ft. apart, ¾ in. by 1½ in., and 15 in. long, one end caulked and built into wall, the other end tapped, and screwed to frame with stout screws, the heads let in and covered.

Attend on Bellhanger. 311. Cut away for and make good after him, and supply and fix 1¼ in. deal beaded bell-boards in six places.

Attend upon, cut away for, and make good after, plumber and gasfitter.

Preparation for Safes. 312. Fit up the floor under each of the best baths for the whole space enclosed, and lay with 1 in. rough boarding traversed for the lead with a fall towards the outlet for the waste, and form a dishing around the outlet. The outer edge all around to have a 2 in. by 2½ in. splayed fillet to dress the lead over.

Similar preparation to be made under the porcelain bath and the w.c.'s. For the unenclosed pedestal w.c.'s this shall be the whole width of the apartment, by 20 in.

Put similar fillet all around the area of floor beneath cisterns.

Third Floor.

Floor. *See Notes, p. 462.* 313. Lay the floors with 1¼ in. yellow battens, straight joint, with splayed headings and mitred borders to hearths.

Steps between Levels of Floors. 314. Form the steps between the two levels of the floors of 1¼ in. treads, with rounded nosings and 1 in. risers, all

rebated and grooved together, glued, blocked, and bracketed on strong fir carriages, and housed to $1\frac{1}{4}$ in. wall string to match the adjacent skirtings.

Skirtings. *See Notes, p.* 463.

315. The cistern-room to have 1 in. by 7 in. square skirting.

The other rooms and passages on this floor to have 1 in. by 7 in. hollow-moulded skirting, the lower edge rebated and let into groove in floor. (For Cement Skirting to Landing, see "Plasterer.")

Doors. *See Notes, p.* 467.

316. The door of cistern-room to be 2 ft. 6 in. by 6 ft. 9 in., $1\frac{1}{2}$ in. four panel ovolo moulded and square, hung with $3\frac{1}{2}$ in. iron butts to $1\frac{1}{4}$ in. jamb linings, double rebated. Fit the door with Archibald Smith's (Battersea) 6 in. mortise lock, with strong brass binate furniture; finish on each side with 1 in. by 3 in. architrave, twice hollow moulded 1 in. girth.

Similar door to room No. 5, but with $1\frac{1}{2}$ in. moulded fixed fanlight 2 ft. high, and $1\frac{1}{2}$ in. transome four times rebated.

The other doors on this floor to be all as first described, but 2 ft. 9 in. by 6 ft. 9 in.

Windows. *See Notes, p.* 464.

317. For Dormers and Skylights, see "Carpenter."

Fit the staircase window with deal-cased frame of $3\frac{1}{2}$ in. teak, double-sunk, weathered, and check-throated sill, $1\frac{1}{4}$ in. deal pulley stiles, 1 in. inside and outside linings, $\frac{3}{4}$ in. back linings, and proper beads and parting slips, the inside linings hollow moulded to form hollow joints with beads, which are to be twice hollow-moulded, and screwed with brass screws and cups, 2 in. moulded sashes, with extra large moulded bars, the upper part in small squares, hung with Austin's No. 8 best patent twine lines, fitted with best brass axle pulleys and iron weights, and grooved all around for finishings. Fit each pair of sashes with $2\frac{1}{2}$ in. Hopkinson's brass sash fastening.

Finish inside with $1\frac{1}{4}$ in. by 2 in. nosing, rebated and twice hollow-moulded, and 1 in. by $1\frac{1}{2}$ in. rebated bed moulding let in under, the ends returned and mitred. Finish around with 1 in. by 3 in. architrave, twice hollow-moulded.

Fit the window opening in gable (room 1) with 3 in. by 6 in. teak sill, double-sunk, weathered, check-throated,

Windows. moulded $1\frac{1}{4}$ in. girth, $3\frac{1}{2}$ in. by $4\frac{1}{2}$ in. fir frame, rebated, $3\frac{1}{4}$ in. girth twice moulded, $1\frac{1}{4}$ in. girth and once grooved; $4\frac{1}{2}$ in. by 6 in. transome, rebated $3\frac{1}{4}$ in. girth, twice sunk, weathered, check-throated, moulded 3 in. girth, and twice moulded $1\frac{1}{4}$ in. girth; $4\frac{1}{2}$ in. by 6 in. mullions, twice rebated, $3\frac{1}{4}$ in. girth twice moulded, $1\frac{1}{4}$ in. girth, and once moulded 3 in. girth; 2 in. moulded casements, with extra large moulded bars, in small squares. The opening casement to be hung with 3 in. brass butts, and to be fitted with brass bronzed casement stay-bar fastening.

Finish inside with $1\frac{1}{4}$ in. by 7 in. window-board, rebated and twice hollow-moulded, with 1 in. by $1\frac{1}{2}$ in. bed moulding as before; 1 in. linings, and 1 in. by 3 in. architrave, twice hollow-moulded.

Finish around the outside of frame with $1\frac{1}{4}$ in. by $\frac{7}{8}$ in. deal fillet, moulded and scribed to brickwork.

Fittings—Ladder. *See Notes, p.* 470.

318. Supply for access to roof a deal ladder 12 ft. in length and 15 in. wide of 3 in. by 2 in. sides, and 2 in. by 2 in. rounds, 9 in. apart, dovetailed and screwed together, and with iron hooks and eyes.

Cistern Cover.

319. Supply cover to cistern of $\frac{3}{4}$ in. matched, ledged and beaded boarding, part hung as flap with 15 in. cross garnet hinges, the top screwed to a 3 in. by $1\frac{1}{4}$ in. rim dovetailed at angles.

Cupboard in Bedroom 20.

320. Construct the cupboard in bedroom No. 20 with $1\frac{1}{2}$ in. beaded front, 7 ft. in height, with $1\frac{1}{2}$ in. four-panel square-framed door, hung with 3 in. iron butts. Fit with 3 in. iron cupboard lock and $2\frac{1}{4}$ in. brass button and plate. Finish around the door on the inside with $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. rounded stop, put 1 in. wrought both sides top, projecting over front with 2 in. by 1 in. architrave moulding as bed mould.

Second Floor.

Floors in Deal.

321. Lay the floors not otherwise described with $1\frac{1}{4}$ in. yellow batten floor as described for the third floor, but ploughed and tongued with $1\frac{1}{4}$ in. galvanized hoop iron.

Floors in Pitch Pine.

322. Lay the floors of bedroom No. 16 and of the dressing-room adjoining with $1\frac{1}{4}$ in. pitch pine floor, in 4 in. widths, ploughed and tongued with $1\frac{1}{4}$ in. galvanized hoop iron.

Floors in Oak.

323. Lay the floors of bedrooms Nos. 9 and 10 with 1 in.

wainscot floor in $3\frac{1}{2}$ in. widths, rebated and side nailed, with splayed headings and mitred borders to hearths on 1 in. deal batten sub-floor, wrought, laid straight joint, and carefully traversed to receive the oak floor. The oak floor to be carefully traversed and left thoroughly smooth.

Parquet Border. 324. Lay all around the boudoir for a width of 2 ft. oak parquet plain pattern floor $\frac{1}{2}$ in. thick, glued in sections, on a backing of three $\frac{1}{2}$ in. thicknesses of thoroughly seasoned yellow pine, crossing each other and glued together. Reduce the depth of the joists to receive this. The parquet to be left thoroughly smooth and to be wax polished in the best manner.

Skirtings in Deal. 325. Put to all the floors not otherwise described 1 in. by 9 in. deal moulded skirting.

Skirtings in Pitch Pine. 326. Put in bedroom No. 16 and the dressing-room adjoining skirting to detail, 11 in. total height in two pieces, rebated and grooved together, the lower part $1\frac{1}{2}$ in. by 6 in. hollow moulded, the upper 2 in. by $5\frac{1}{2}$ in. moulded.

Dado in Oak. 327. Put all around bedrooms Nos. 9 and 10 a dado 7 ft. total height all to detail, of $1\frac{1}{4}$ in. oak framing, 4 panels in height, flush framed at back and moulded 1 in. girth on solid on face, the moulding on the stiles stopped with run-out stops, the upper edge of rails chamfered 1 in. wide, the lower stop moulded $\frac{3}{4}$ in. girth with run-out stops. The angles to be rebated and grooved together, the external ones to be moulded to match the stiles. The skirting to be 7 in. by $1\frac{1}{4}$ in., moulded and rebated on upper edge, and the dado rebated to receive it. The capping to be in two pieces, rebated and grooved together and moulded, the upper $1\frac{1}{2}$ in. by $2\frac{3}{4}$ in., the lower 1 in. by $1\frac{1}{2}$ in.; the whole fixed with brass screws and cups, for convenience of removal, to four rows of 1 in. by 3 in. deal grounds, fixed horizontally.

Windows in Deal. 328. Fit all window openings not otherwise described with deal cased frames of 1 in. inside and outside linings, $1\frac{1}{4}$ in. pulley stiles, $\frac{1}{2}$ in. back linings, with proper beads and parting slips, all rebated and grooved together; $3\frac{1}{2}$ in. teak double-sunk, weathered, and check-throated sills and 2 in. moulded sashes, with large moulded bars in small squares, double hung with No. 6 extra fine twine sash line equal to sample to be seen at the architect's office, and Gibbon's (Wolverhampton) patent roller axle pulleys, List Price 26*s*.

per dozen, and iron weights. Fit each pair of sashes with a 3 in. brass-bronzed sash fastening. P. C. 2*s*. 6*d*. Finish inside with 1¼ in. rebated and twice hollow-moulded window boards, with 1 in. by 1½ in. rebated bed moulding let in beneath, with the ends returned, and mitred 1 in. linings and 2½ in. by 1¼ in. moulded architraves.

Windows in Pitch Pine. 329. The windows in bedroom No. 16 and dressing-room adjoining to be all as last, but the inside linings of the frames, the linings and the architraves to be of pitch pine.

Windows in Oak. 330. The windows of bedrooms Nos. 9 and 10 and boudoir shall have 4½ in. by 3½ in. rebated and twice ovolo-moulded frames, 4½ in. by 4½ in. twice rebated and four times ovolo-moulded mullions, 4½ in. by 4½ in., transome sunk, weathered, and throated and thrice ovolo-moulded, and 4½ in. by 3½ in. double-sunk, weathered, and check-throated sills. The casements to be 2 in. moulded, fitted with beads, screwed with brass screws and cups for plate glass, hung with 3 in. brass butts and fitted with brass casement stays, P. C. 3*s*. 6*d*. each, and brass casement fastening. P. C. 3*s*. each.

Finish inside the southern windows with 1¼ in. rebated window board with moulded edge, and 1 in. by 1¼ in. rebated bed moulding let in beneath 1 in. linings and 3 in. by 2 in. moulded architrave.

The edges of the opening casements to be rebated and rounded as Fig. 15, with grooves in the frame to correspond.

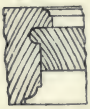

FIG. 15.

Doors in Deal. 331. The doors not otherwise described to be 2 ft. 9 in. by 6 ft. 9 in., 2 in. four panel moulded both sides, hung with 3½ in. iron butts to 1½ in. double rebated jamb linings. Fit with 6 in. mortise lock and brass furniture; finish on both sides with 2½ in. by 1¼ in. moulded architraves. Bedrooms 11 and 12 to have 2 in. moulded fanlights 12 in. high in single squares, fixed with 2 in. transomes four times rebated. Similar doors to housemaid's closet and servants' w.c., but moulded on one side only. Instead of lock the w.c. door shall have a 5 in. brass mortise latch with brass furniture and a 5 in. brass barrel bolt.

Swing Door. 332. The door between front and back corridor to be 3 ft. by 7 ft., 2 in. three panel moulded both sides door, the upper panel with diminished stiles and prepared for glass

with movable mouldings screwed with brass screws and cups. Round both edges of the door. Hang with Archibald Smith's (Queen's Road, Battersea) double-action "model" swing hinges let into an oak block framed between the joists. Fit the door with two brass grip handles. P. C. 10*s.* each. The linings to be 2 in. ovolo moulded both edges, and hollowed for the swing door. Finish on both sides with $2\frac{1}{2}$ in. by $1\frac{1}{4}$ in. moulded architraves.

Doors in Pitch Pine. 333. The doors of bedroom No. 16 and dressing-room adjoining to be as last described, but in pitch pine, hung with $3\frac{1}{2}$ in. brass butts to jamb linings as last, but in pitch pine, fitted with 6 in. brass rim lock with brass oval furniture, P. C. 24*s.* in all, and four brass finger plates, P. C. 1*s.* 6*d.* each, finish with $2\frac{1}{2}$ in. by $1\frac{1}{4}$ in. moulded architrave of pitch pine in the room, and deal next corridor.

Doors in Oak. 334. The doors of bedrooms Nos. 9 and 10 and boudoir to be 3 ft. by 7 ft., 2 in. five panel moulded both sides, hung with $3\frac{1}{2}$ in. brass butts with steel washers and pins to $1\frac{1}{2}$ in. jamb linings, double rebated and framed, and moulded in seven panels the set. Fit with 6 in. brass rim lock and furniture, P. C. 25*s.* in all, and four finger plates, P. C. 2*s.* each. Finish around on the room side with 3 in. by 2 in. moulded architrave, and on the corridor side with $2\frac{1}{2}$ in. by $1\frac{1}{4}$ in. deal moulded architrave.

Shutters in Deal. 335. Fit the windows of rooms 7 and 8 with $1\frac{1}{4}$ in. one panel framed and moulded soffit, $1\frac{1}{4}$ in. moulded window back, and elbows, with $\frac{3}{4}$ in. beaded capping, and the skirting of the room carried around them, $1\frac{1}{4}$ in. one panel moulded and framed soffit, 1 in. bead flush framed back linings, $\frac{3}{4}$ in. return linings, $\frac{3}{4}$ in. beaded cap to elbows, $\frac{3}{4}$ in. soffit to boxing, $1\frac{1}{4}$ in. beaded blind rails, $1\frac{1}{4}$ in. moulded and square shutters, and 1 in. beaded back flaps, all hung folding, and rebated and beaded at all edges. Hang the set of shutters with four pairs of $2\frac{1}{2}$ in. iron back flaps and four pairs of $2\frac{1}{2}$ in. iron butts. Fit with 24 in. iron Japanned shutter bar and two brass shutter latches with brass ornamental knobs. The knobs P. C. 1*s.* 3*d.* each. Finish with architraves to match those of doors.

Shutters in Oak. 336. Fit the northern windows of bedrooms Nos. 9 and 10 and boudoir with shutters all as last, but in two heights, and of wainscot. Hang each set of shutters with eight

pairs of $2\frac{1}{2}$ in. brass butts and eight pairs of $2\frac{1}{2}$ in. brass back flaps, fit with two 24 in. brass shutter bars and four brass shutter latches, with brass ornamental knobs. The knobs P. C. 2*s*. each. Finish with architraves to match those of doors.

FITTINGS.

Cupboards in Deal.

337. Construct each of the cupboards in bedrooms Nos. 7 and 8 the whole height of the storey of $1\frac{1}{2}$ in. square framed front and ends, the salient angles rebated, grooved, and staff-beaded. The doors to be $1\frac{1}{2}$ in. square framed, hung with 3 in. iron butts in two heights, the lower door four panels, the upper two. Fit each door with a 3 in. brass cupboard lock and a strong brass knob turnbuckle. Finish around each door on the inside with $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. rounded stop. Fix about 6 ft. 6 in. from floor $1\frac{1}{4}$ in. wrought both sides shelf. Fix below this shelf, at the back and ends of cupboard, $4\frac{1}{2}$ in. by 1 in. rail, ovolo-moulded on the edges, and six brass hat and coat hooks. P. C. 1*s*. 3*d*. each.

Housemaid's Closet in Deal.

338. Fix in housemaid's closet $1\frac{1}{2}$ in. wrought top along one side of the room, form opening therein for sink with rounded edge, and supply sink 2 ft. 6 in. by 1 ft. 6 in. and 1 ft. 3 in. deep (all in clear) of $1\frac{1}{4}$ in. dove-tailed sides and $1\frac{1}{2}$ in. bottom screwed on, all prepared to receive lead, and supported by $2\frac{1}{2}$ in. by $2\frac{1}{2}$ in. wrought bearers.

Finish along back and ends with 9 in. by $\frac{3}{4}$ in. chamfered flushing board (prepared for lead). Groove the top at each end of sink with diminishing grooves 1 in. wide and $\frac{1}{2}$ in. deep, extreme falling towards the sink.

Enclose the space beneath with $1\frac{1}{4}$ in. framed and beaded front and two pairs of $1\frac{1}{4}$ in. square framed folding doors in two panels the set, hung folding with 3 in. iron butts. Fit each pair of doors with a strong brass knob turnbuckle and a 4 in. iron flat-necked bolt.

Shelves in Linen Room in Deal.

339. Fit the linen room with four tiers of shelves, the lowest $1\frac{1}{2}$ in. wrought both sides, and 2 ft. 6 ins. wide the three upper ones, lattice shelves of $1\frac{1}{4}$ in. by 2 in. laths 1 in. apart on 3 in. by 3 in. wrought and framed posts and bearers about 3 ft. apart.

340. Supply in housekeeper's room the whole length of western side and the whole height of the storey $1\frac{1}{2}$ in.

House-keeper's Cupboard in Deal. framed and beaded cupboard front; put at the bottom 1 in. pot-board and bearers and skirting to match the skirting of the room. Divide the height into three by two $1\frac{1}{4}$ in. wrought shelves, divide vertically by $1\frac{1}{4}$ in. wrought divisions when required, and put $1\frac{1}{4}$ in. ends. Fit the space between the pot-board and the shelf above it with eight drawers of $1\frac{1}{4}$ in. beaded and secret dovetailed fronts, $\frac{3}{4}$ in. dovetailed rims, and $\frac{3}{4}$ in. bottom with 1 in. by $\frac{1}{2}$ in. Honduras mahogany, glued blocking. Let into and glue into the pot-board 2 in. by $\frac{3}{4}$ in. teak fillets, and screw to the bottom of the side rims of drawer $\frac{3}{4}$ in. by $\frac{1}{2}$ in. teak fillets as runners. Fit each drawer with two 3 in. brass flush draw handles, and a 3 in. brass drawer lock. P. C. 2*s*. 6*d*.

Fit the space above these drawers with four pairs of $1\frac{1}{2}$ in. square framed doors in four panels the set, each pair hung with $2\frac{1}{2}$ in. iron butts, fitted with two 4 in. iron flat-necked bolts, 3 in. brass cupboard lock, P. C. 3*s*., and strong brass knob turnbuckle.

Fit the space above last with similar doors to last with similar ironmongery, but in two panels the set.

Fit to the divisions and ends 1 in. by $\frac{1}{2}$ in. wrought fillets as stops for the doors.

Servants' W.C. in Mahogany. 341. Fit the servants' w.c. with a polished teak w.c. seat, Bolding's (Grosvenor Works, London) No. 132.

Boudoir W.C. in Mahogany. 342. Fit the w.c. adjoining boudoir with 1 in. seat with rounded nosing and $1\frac{1}{4}$ in. one panel moulded and framed riser, 1 in. mortise and mitre-clamped flap with $2\frac{1}{4}$ in. by $1\frac{1}{2}$ in. moulding tongued on front edge. Hang the flap with $2\frac{1}{2}$ in. brass butts.

Cut and dish a shaped hole in seat for pan, cut and bead a hole for handle.

Finish around the seat with $1\frac{1}{4}$ in. back and elbows 15 in. high, framed and moulded, and one panel in height, the exposed edges to be moulded, and the angles rebated and grooved together. Fix the whole, to remove easily, with oak button blocks and brass screws and cups on strong fir bearers.

Case the water-waste preventing cistern with casing of similar mahogany 1 in. top and bottom and $1\frac{1}{4}$ in. moulded and framed front, part hung as door with 2 in. brass butts

and fitted with strong brass turnbuckle with furniture to match the room door furniture. Fix the whole, to remove easily, with brass screws and cups.

Bath Casing in Spanish Mahogany. 343. Fit the bath in Spanish mahogany with $1\frac{1}{4}$ in. framed top with rounded nosing and $1\frac{1}{2}$ in. by 1 in. bed moulding rebated and let into top, form opening for bath with quadrant corners and rounded edges. Enclose the space beneath with $1\frac{1}{4}$ in. framing, one panel high, with moulded panels. Form a small one panel door in the framing, rebate the door and framing all around as stop, hang with $2\frac{1}{2}$ in. brass butts, and fit with strong brass turnbuckle with ornamental knob. P. C. 3*s*.

Finish back and ends of top with 1 in. by 9 in. moulded skirting with moulded ends.

Supply a stout deal cradle for the bath.

Fit the whole of the woodwork of the bath, to remove easily, with oak button blocks and brass screws and cups.

Cornice in Oak. 344. Supply cornice to boudoir moulded 15 in. girth to detail.

Picture Rail in Oak. 345. Supply picture rail $1\frac{1}{2}$ in. by 2 in. in boudoir, moulded to detail, and fixed to 1 in. by 3 in. deal, twice splayed, ground.

Chair Rail in Oak. 346. Supply a chair rail 2 in. by 3 in. in boudoir, moulded to detail, and fixed to 1 in. by 3 in. deal ground as last.

First Floor.

Similar to second floor.

Fittings Slop Sink in Deal. 347. Fit the slop sink with $1\frac{1}{4}$ in. top with rounded nosing part as deal beaded frame with $1\frac{1}{4}$ in. mortise and mitre-clamped flap hung therein with 3 in. brass butts, and $1\frac{1}{4}$ in. square framed and beaded front with two doors, each hung with 3 in. iron butts, and fitted with strong brass knob turnbuckle. Finish the back and ends of top with 1 in. by 7 in. square skirting.

Bath Casing in Spanish Mahogany. 348. The casing to this bath to be made to detail and generally to match that to bath room on second floor, but it shall be carried up at one end to form a canopy with a moulded cornice $4\frac{1}{2}$ in. by 3 in. and moulded 7 in. girth, all to detail.

Ground Floor.

Floors in Deal. 349. Lay all the floors not otherwise described with $1\frac{1}{4}$ in. floor as described for second floor.

Lay the floors of butler's pantry, housekeeper's room, and still room with $1\frac{1}{4}$ in. yellow battens, as last, but ploughed and tongued with $1\frac{1}{4}$ in. galvanized hoop iron.

Floors in Pitch Pine. 350. Lay the floors of library and billiard room with $1\frac{1}{4}$ in. pitch-pine, as described for bedroom No. 16, second floor.

Lay the floor of kitchen with 2 in. wrought pitch-pine strips 3 in. wide, in 9 in. lengths, and every block gauged laid, herring bone with a very close joint, with straight border, the blocks dipped in a boiling mixture of 1 part pitch to 3 parts Stockholm tar. Traverse the whole surface after laying, and leave thoroughly smooth.

Floors in Oak. 351. Lay the floors of dining-room, drawing-room, and inner hall with $1\frac{1}{4}$ in. wainscot floor, with Putney's Pavodilos joint laid straight, joint side nailed, with splayed headings and mitred borders to hearths, on 1 in. deal batten wrought sub-floor, laid straight joint and carefully traversed to receive the oak floor.

Thoroughly traverse and scrape the oak floor and wax polish in the best manner.

Parquetry. 352. Lay around drawing-room for a width of 3 ft., and in the best manner, inlaid parquetry flooring $\frac{1}{2}$ in. thick, P. C. 3*s.* per foot superficial laid, the oak floor rebated to receive it to be wax polished to match the remainder of the floor.

Skirtings in Deal. 353. Supply in the china store, housekeeper's store, and boot room 1 in. by 7 in. square skirting. Supply in the kitchen corridor, servants' hall, butler's pantry, and footman's room 1 in. by 7 in. Torus skirting.

Skirtings in Pitch Pine. 354. Supply in library and billiard room skirting 12 in. high in all, to detail, in two pieces 7 in. by $1\frac{1}{2}$ in. and 6 in. by $1\frac{1}{4}$ in. respectively, rebated and grooved together and the lower edge rebated and let into the floor.

Skirtings in Oak. 355. Supply in dining and drawing-room skirting $15\frac{1}{2}$ in. high, to detail, in three pieces rebated and grooved together, the moulding $2\frac{1}{2}$ in. by 5 in., surbase 1 in. by

6 in., base $1\frac{1}{2}$ in. by 5 in., the lower edge rebated and let into the floor.

Windows in Deal.

356. Fit all the window openings not otherwise described with deal cased frames and sashes, as described for second floor. Finish inside with 1 in. linings, $1\frac{1}{4}$ in. rounded window boards, and $1\frac{1}{2}$ in. by 1 in. moulded architraves.

Supply for the inside of larder window $1\frac{1}{4}$ in. skeleton framed doors, rebated for and filled in with fly-wire secured by beads, hung folding to the inside linings of the windows with 3 in. iron butts. Fit with 4 in. iron neck bolt, and strong brass knob turnbuckle. Fix 1 in. by $\frac{1}{2}$ in. fillet as stop on linings and window board.

Borrowed Lights in Deal.

357. The borrowed light between housekeeper's room and corridor and china closet and corridor to be 3 ft. by 2 ft. 6 in., 2 in. moulded fixed sash with large moulded vertical bars (the whole height) fixed in the middle of 1 in. deal linings. Finish all around on both sides with $2\frac{1}{2}$ in. by $1\frac{1}{4}$ in. moulded architraves. Fix to the linings all around the sash on both sides $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. hollow moulded fillet.

Ceiling Light in Deal.

358. The ceiling light in garden entrance lobby to be $2\frac{1}{4}$ in. moulded light with $2\frac{1}{4}$ in. by 2 in. moulded bars disposed as Fig. 16, or similar thereto, with $1\frac{1}{2}$ in. by 9 in. linings, rebated and the lower edge moulded. Fix beneath the light all around as bed moulding 2 in. by $1\frac{1}{2}$ in. moulded fillet.

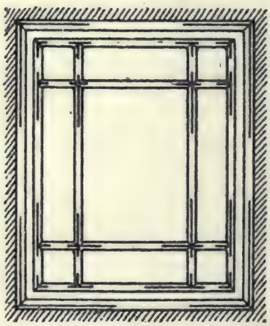

Fig. 16.

Windows in Oak with Linings of Pitch Pine.

359. Construct the windows of library and billiard room of oak, $5\frac{1}{2}$ in. by 4 in. rebated and twice ovolo-moulded frames, $5\frac{1}{2}$ in. by $5\frac{1}{2}$ in. twice-rebated and four times ovolo-moulded mullions, $5\frac{1}{2}$ in. by $5\frac{1}{2}$ in. transomes, sunk, weathered, check-throated, and thrice ovolo-moulded, and $5\frac{1}{2}$ in. by $3\frac{1}{2}$ in. sills, double sunk, weathered, and check-throated. The casements to be 2 in. moulded in single squares and fitted with beads screwed with brass screws and cups to receive plate-glass. Fit the opening casements with brass-bronzed casement stays, P. C. 5*s*. each, and brass-bronzed casement fastenings,

P. C. 4*s*. 6*d*. each, and hung with 3 in. brass butts with steel washers and pins. Finish inside with 1 in. pitch-pine linings, 1¼ in. pitch-pine window board twice ovolo-moulded, and with 2 in. by 1½ in. rebated bed moulding. Finish with 3 in. by 1½ in. moulded architraves.

Windows in Oak with Oak Linings, &c. *See Notes*, *p*. 473.

360. Fit the windows of dining and drawing-rooms with oak frames and casements and ironmongery as last described, but with exceptions hereafter mentioned. Finish on the inside with 1½ in. moulded and framed linings in eight panels the set, with small astragals let in and mitred on the faces of the panels, 1½ in. moulded and framed window backs one panel high, to match the linings, and 1¼ in. twice ovolo-moulded capping, with 2 in. by 1½ in. rebated bed moulding, and 3 in. by 1½ in. moulded architraves. Carry the skirting of room across the window back and elbows.

Such of the casements above the transomes as open shall be hung at bottom with 3½ in. brass butts with steel washers and pins, and shall be fitted with R. Adams's (Newington Causeway, London) all brass quick-speed patent fanlight opener.

Construct and fit the bay window of drawing-room in all respects as last, but the angle mullions to be 10 in. by 8½ in. extreme dimensions, rebated and tongued with oak cross-tongues, as Fig. 17. The architraves to be rebated together on the internal angles.

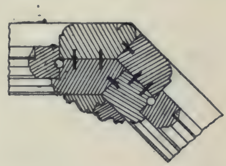

Fig. 17.

Doors in Deal.

361. The whole of the doors not otherwise described to be 2 ft. 9 in. by 7 ft., 2 in. four panel square framed, hung with 3½ in. iron butts to 1½ in. double rebated jamb linings. Fit with 6 in. mortise locks and brass furniture. Finish with 1½ in. by 1 in. moulded architraves.

The larder doors to be as last, but with diminished stiles, and the upper panels filled in with stout perforated zinc, fixed with beads and brass screws and cups.

The doors of wood shed, coal shed, and lamp room to be 3 ft. by 7 ft., 2 in. framed and braced, filled in with 1 in. grooved, tongued, and beaded boarding in 3½ in. widths, hung with 4 in. iron butts to 4½ in. by 3½ in. rebated and twice narrow-chamfered frames. Fit with 6 in. upright

Doors in Deal.

mortise locks and strongest iron thumb-latches. Finish on the inside with 1 in. by 3 in. twice-chamfered architraves.

The door of garden entrance to be 2¼ in. framed, the lower part filled in with 1¼ in. tongued, grooved, and moulded both sides boarding in 4 in. widths, the upper panel rebated and prepared for glass, with large moulded bars and movable mouldings, fixed with brass screws and cups, converted on the inside into five panels, the stiles stop moulded, the rails splayed one edge and moulded the other, hung with 3½ in. iron butts to 4½ in. by 3½ in. rebated and twice ovolo-moulded frame.

The door of kitchen entrance to be 3 ft. by 7 ft., 2 in. four panel bead, flush and square, hung with 4 in. butts to 4½ in. by 4 in. rebated and twice narrow-chamfered frames, with 4½ in. by 4 in. rebated, sunk-weathered and thrice narrow-chamfered transome.

Fig. 18.

Supply and tongue to the bottom rail a 3 in. by 2 in. moulded weather fillet, as Fig. 18.

Fit with 7 in. mortise lock with strongest brass furniture and two 9 in. Tower bolts. Put over door 2 in. moulded fixed fanlight, with large moulded bars. Finish with 1½ in. by 1 in. moulded architrave.

Doors in Pitch Pine.

362. The doors of library and billiard room to be 3 ft. by 7 ft., 2 in. five panel, moulded both sides, hung with 3½ in. brass butts, with steel washers and pins, to 1½ in. double-rebated framed and moulded jamb linings, in eight panels the set. Fit with 6 in. mortise locks. Fit with ornamental brass furniture, P. C. 10*s*. per set, and four brass finger plates, P. C. 2*s*. 6*d*. each. Finish with 3 in. by 1½ in. moulded architraves of pitch pine on the room side, and deal on the corridor side.

The door of w.c. adjoining billiard room to be 2 ft. by 6 ft. 9 in., 2 in. four panel, moulded both sides, hung with 3½ in. brass butts, with steel washers and pins, to 1½ in. double-rebated jamb linings, moulded both edges.

Fix with 5 in. brass mortise latch, with ornamental brass furniture, P. C. 10*s*. per set, four brass finger plates, P. C. 2*s*. 6*d*. each, and Ashwell's special "Navy" polished brass indicating bolt. Finish with architraves to match those adjacent.

Doors in Oak. 363. The doors of dining and drawing-rooms to be 2 in. six panel moulded both sides, with small astragal mitred and let in to face of panels, hung with $3\frac{1}{2}$ in. brass butts, with steel washers and pins, to $1\frac{1}{2}$ in. double-rebated jamb linings, framed and moulded in eight panels the set, to match the doors. Fit with ironmongery as last described. Finish with 3 in. by $1\frac{1}{2}$ in. moulded architraves of oak on the room side, and deal on the corridor side.

The door to w.c. adjoining cloak room to be in all respects like that of billiard room w.c., but in oak.

The sliding doors between the drawing-rooms shall be 2 in. moulded both sides, in two leaves, to match the other doors adjacent, with vertical flush bead to imitate four leaves. Rebate and mould the meeting rails as sketch (Fig. 19). Fix with four brass ornamental flush lifts, P. C. 5*s.* each, four finger plates, P. C. 2*s.* 6*d.* each, a brass clutch lock, P. C. 20*s.*, and six Hatfield's patent bottom rollers, but gun-metal, and mortised in. Supply 2 in. by 1 in. polished gun-metal running rail let into floor, and fixed with brass screws, with the heads countersunk, the rail to have three stops cast on. Groove the soffit of the linings with a square groove $\frac{1}{2}$ in. deep for the door to run in. Frame the linings of the jambs as other linings in these rooms, but in two widths for the door to pass. The soffit to be in one width. Line inside the two thicknesses of quarter partition 6 in. beyond the width of each leaf with $\frac{3}{4}$ in. matched and beaded boarding. Fix the skirting on each side of the partition and the linings with brass screws and cups to remove.

FIG. 19.

Finish with architraves to match those of the other doors in these rooms, but fix with brass slotted plates and brass screws, about 12 in. apart.

The front entrance door to be $2\frac{1}{4}$ in., 3 ft. 6 in. by 7 ft. 6 in., eight panel, moulded inside, and on the outside bolection moulded, with raised panels, with sunk and mitred margins, and small moulding on the raising, hung with three 5 in. brass butts, with steel washers and pins, to $5\frac{1}{2}$ in. by 4 in. frame in four pieces, tongued and glued together with oak cross-tongues, made up of yellow deal core $3\frac{3}{4}$ in. by 3 in., two pieces of $3\frac{1}{2}$ in. by $1\frac{1}{4}$ in. wainscot, rebated one

edge, and one piece of wainscot $5\frac{3}{4}$ in. by 2 in., rebated and moulded, $1\frac{1}{2}$ in. girth, as Fig. 20. Fit with 7 in. mortise

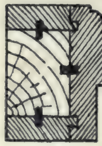

Fig. 20.

dead lock, and a Chubb's (128, Queen Victoria Street) flush latch, with brass knob and two keys, List Price, 24*s*., a brass-bronzed closing handle, P. C. 30*s*., and one 14 in. by $1\frac{1}{2}$ in., and one 12 in. by $1\frac{1}{4}$ in. brass registered sunk lever flush bolt. Finish on the inside with inch linings, and 3 in. by $1\frac{1}{2}$ in. architraves.

Screen in Oak. 364. Construct the screens between the vestibule and the hall of $4\frac{1}{2}$ in. by 4 in. frame, rebated and twice ovolo moulded, $4\frac{1}{2}$ in. by $4\frac{1}{2}$ in. mullions and transome, twice rebated and four times moulded, 2 in. three panel moulded both sides door, the upper panel with diminished stiles rebated and prepared for glass, with shifting mouldings, screwed with brass screws and cups. Hang with Archibald Smith's double-action model swing hinges, and fit with two brass grip handles, P. C. 12*s*. each. Round the edges of the door and hollow the frame.

Fill in the spaces on each side of the door with framing to match the door.

Fix over transome 2 in. moulded fanlights, with large moulded bars.

Finish on both sides of frame with 2 in. by $1\frac{1}{2}$ in. moulded scribing fillet, planted on the frame.

Fittings in Oak—Picture Rail. 365. Supply in dining and drawing-rooms 3 in. by 2 in. picture rail, moulded to detail, fixed to 1 in. by 3 in. deal twice-splayed grounds.

Fittings in Teak—Pantry Sink. 366. Fit the sink in pantry with cover of $1\frac{1}{4}$ in. mortise and mitre-clamped flap with rounded nosing, and hung with 3 in. brass butts to beaded frame. Enclose the space beneath with $1\frac{1}{4}$ in. beaded frame and square-framed doors, hung with 3 in. brass butts. Fit with two 3 in. brass barrel bolts and brass knob turnbuckle. Finish at the back of the top with 9 in. by 1 in. ovolo-moulded skirting.

House-keeper's W.C. 367. Fit the housekeeper's w.c. with teak-shaped w.c. seat, $1\frac{1}{8}$ in. thick, of two pieces laid with the grain at right angles, and secured with brass screws, the upper piece to have the edge rounded, the lower piece beaded and fitted with three indiarubber buffers and dished shaped hole, and hung with a pair of 3 in. brass butts to $1\frac{1}{4}$ in. back rail,

beaded on upper front edge, and secured to brickwork by two galvanized cast-iron brackets, screwed with brass screws to oak plugs, and 1 in. by 5 in. skirting, with its upper edge and ends rounded, screwed with brass screws to back rail, the back rail cut away and shaped to let flushing pipe through, and the skirting taken round the portion so cut away. Two paper boxes $\frac{3}{4}$ in. thick, dovetailed together, and fixed to back rail, the spaces between boxes covered with a piece of $\frac{3}{4}$ in. cut and shaped to receive flushing pipe, the front and two sides of cover and upper edges of paper boxes rounded.

Fittings in Deal—Mantle Shelves.

368. Supply to kitchen chimneypiece 11 in. by 2 in. wrought shelf, with small quadrant corners, fix it to the brickwork by two iron dowels, and screw it to the slate cantilevers with four 3 in. screws, the heads let in and covered.

Supply similar shelf for scullery chimneypiece, but 9 in. by $1\frac{1}{2}$ in.

Dresser.

369. Supply kitchen dresser 9 ft. long and 8 ft. high, the top to be of 2 in. deal with small quadrant corners, $1\frac{1}{4}$ in. shaped standards, 9 in. extreme width, four tiers of 1 in. shelves of various width, and arris grooved for plates, $\frac{3}{4}$ in. by 1 in. bead housed into top as stop for plates; put 1 in. top and $\frac{3}{4}$ in. by 7 in. beaded fascia and $2\frac{1}{2}$ in. by $1\frac{1}{4}$ in. architrave as cornice. Support the top by 3 in. by 3 in. wrought legs and bearers. Fix below top four drawers 9 in. deep, of 1 in. beaded fronts, $\frac{3}{4}$ in. dovetailed rims, and $\frac{3}{4}$ in. bottom, glued and blocked; screw on the rims $\frac{3}{4}$ in. by $\frac{3}{4}$ in. oak runners. Frame above and below the drawers 3 in. by 2 in. beaded rail; frame into the lower rail 3 in. by 2 in. deal runners. Fit each drawer with two $2\frac{1}{2}$ in. iron cup handles. Put at bottom 1 in. pot-board and bearers. Enclose the ends with $1\frac{1}{4}$ in. square framing and the front with 1 in. framed and beaded with $1\frac{1}{4}$ square-framed doors, hung with 3 in. iron butts. Fit each door with a strong brass turnbuckle. Fix in the cupboard beneath 1 in. wrought both sides shelf, and 1 in. divisions. Fix to the back of dresser $\frac{3}{4}$ in. matched and beaded boarding in 4 in. widths.

Kitchen Cupboard.

370. The kitchen cupboard to be the whole height of the storey, to have $1\frac{1}{2}$ in. framed and beaded front, in two heights. Fit the lower part with $1\frac{1}{2}$ in. square-framed doors, hung folding with 3 in. iron butts. Fit with 3 in. iron cupboard lock, and $2\frac{1}{2}$ in. iron button and plate.

Supply similar doors to the upper part. Finish at top with 3 in. by 2 in. moulding, as cornice. Supply four $1\frac{1}{4}$ in. wrought both sides shelves, with chamfered bearers.

Butler's Pantry Fittings.

371. Supply in butler's pantry on two sides of the room, as shown on Plan, a dresser of 2 in. top, fixed 3 ft. from floor, perforated for two sinks, the edges of the openings rounded, each of the sinks to be 1 ft. 9 in. by 1 ft. 6 in. by 1 ft. 2 in. clear, of $1\frac{1}{4}$ in. dovetailed sides and 2 in. bottom screwed on, and prepared to receive lead. Enclose the space beneath with $1\frac{1}{4}$ in. square framed and beaded front, and sets of square framed doors, hung folding with 3 in. iron butts. Fit each pair of doors with two 3 in. flat-necked bolts and strong brass knob turnbuckle. Finish at back and ends with 1 in. by 9 in. chamfered flashing board. Fix a similar top on the third side of room and fit the cupboard beneath with 1 in. pot-board and bearers. Fit part with $\frac{3}{4}$ in. vertical partitions, shaped on front edge, and about 2 in. apart, as tray rack.

In two places in this cupboard form nests of drawers, 2 ft. wide, constructed as follows: 1 in. ends, beaded one edge, 3 in. by $1\frac{1}{2}$ in. beaded top rail, $2\frac{1}{4}$ in. by $1\frac{1}{2}$ in. twice beaded intermediate rails framed between the ends. Screw to the ends $2\frac{1}{4}$ in. by $1\frac{1}{2}$ in. wrought fillets as drawer runners, frame into the intermediate rails and runners $\frac{1}{2}$ in. wrought dust partitions. Supply three drawers to each nest of 1 in. beaded and secret dovetailed fronts, $\frac{3}{4}$ in. rims dovetailed at angles, $\frac{1}{2}$ in. bottoms, glued and blocked with mahogany blocking, glue and screw to the lower edge of side rims $\frac{3}{4}$ in. by $\frac{3}{4}$ in. teak runner. Screw to the pot-board or dust partitions below each drawer two $1\frac{1}{2}$ in. by $1\frac{3}{8}$ in. mahogany stops. Fit each drawer with two 3 in. brass cup handles and a Tucker & Reeves's (110, Cannon Street, E.C.) $2\frac{1}{2}$ in. brass drawer lock (Fig. 21).

Construct the cupboard over dresser, 7 ft. long and 4 ft. 6 in. high, 14 in. deep, of $1\frac{1}{4}$ in. top, bottom, and sides, all dovetailed at angles and supported by four $1\frac{1}{2}$ in. shaped brackets 14 in. by $14\frac{1}{2}$ in., housed into the dresser top, and twice ovolo moulded on front edge. Fit with 1 in. division and three 1 in. shelves, housed at ends. Finish around top with 2 in. by $1\frac{1}{2}$ in. moulding as cornice. Fit with $1\frac{1}{4}$ in. moulded and square doors, in three leaves,

Pantry Fittings. fitted to slides with Hatfield's patent rollers, mortised into the bottom rails, the upper edge of each door to be grooved. Supply four 1 in. by $\frac{1}{2}$ in. wrought-iron beads as rails and guides let into the top and bottom of the cupboard and 1 in. longer than the clear width of cupboard. Fit each door with two 3 in. brass flush sash lifts. Fit all around the doors to the top, bottom, and ends, inside and outside of the doors, $\frac{3}{4}$ in. by $\frac{1}{2}$ in. beads, fixed with brass screws and cups.

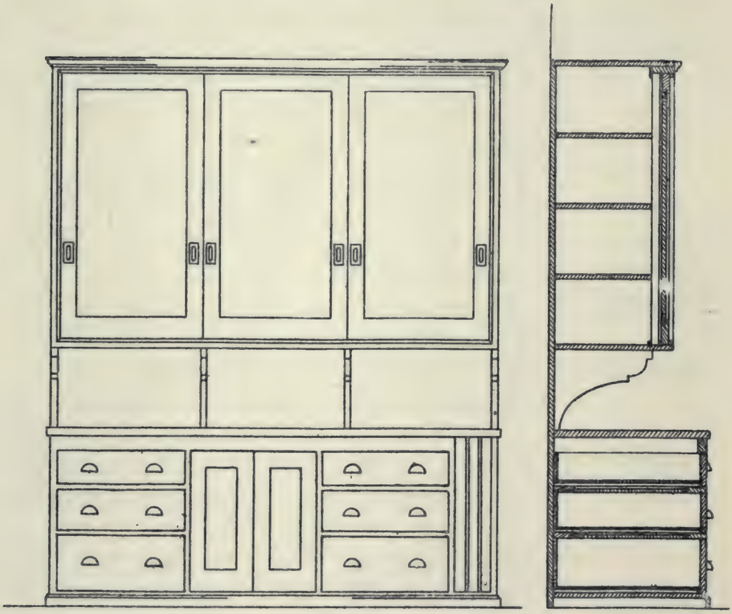

FIG. 21.

Fit the centre door with two Hobbs' (76, Cheapside) brass clutch back-action sliding door locks.

Shelves in China Closet. 372. Fit the china closet with four tiers of $1\frac{1}{4}$ in. wrought both sides shelves, supported by chamfered bearers and stout framed gibbet brackets.

Shelves in Boot Room. 373. Fix in boot room a $1\frac{1}{2}$ in. deal wrought shelf, about 3 ft. from floor, of the width shown on Plan, and the whole length of the room. Fix over it two tiers of 1 in. shelves 11 in. wide.

Serving Hatch. 374. Construct the serving hatch with an opening 2ft. 6in. by 3 ft. in the clear with $1\frac{1}{2}$ in. oak two panel moulded and

square framed shutter, hung with best flax lines and brass axle pulleys, as described, for the windows, and iron weights in cased frame of 1 in. oak inside lining, 1 in. deal outside lining, $1\frac{1}{4}$ in. oak pulley stiles, and $\frac{1}{2}$ in. deal back linings. Finish on the side next serving-room with 1 in. deal linings and $1\frac{1}{2}$ in. by 1 in. deal moulded architraves. Finish on the side next dining-room with 3 in. by $1\frac{1}{2}$ in. oak moulded architrave. Put at 2 ft. 9 in. from floor $1\frac{1}{2}$ in. oak window board, twice ovolo moulded on the dining-room side with bed moulding to match that of window boards, and rounded on the edge next the pantry.

Line the recess above the shutter on the side next the pantry with $\frac{3}{4}$ in. matched and beaded boarding in 4 in. widths.

Fit the shutter on the side next the butler's pantry with two 3 in. brass sunk sash lifts.

Seat of Servants' W.C. 375. Fit the servants' w.c. with Bolding's No. 132 whitewood unpolished double wood seat.

Meat Hooks. 376. Screw to joists over larder twelve 6 in. strong single galvanized iron meat hooks, and two 6 in. double ones.

Copper Lid. 377. Supply for copper in scullery a deal copper lid, of two thicknesses of $\frac{3}{4}$ in. pinned and dowelled together with oak pins, and a deal shouldered handle pinned on with oak pins.

Draining Boards. 377A. Supply to scullery sink and each pantry sink and block up to falls, $1\frac{1}{2}$ in. draining boards of the size shown, with grooves $\frac{3}{4}$ in. wide, $\frac{1}{2}$ in. deep, and 1 in. apart, prepared for metal covering. (See "Plumber," clauses 471 and 472.)

Enclosure to Dinner Lift. 378. Enclose the dinner lift in basement and on ground floor with $1\frac{1}{2}$ in. square framing, the angles tongued and staff beaded. Form on each floor an opening therein 2 ft. wide and 2 ft. 6 in. high, beaded two sides and top with $1\frac{1}{4}$ in. two panel square framed shutter, hung with best flax lines, best brass axle pulleys, and iron weights in a deal cased frame of 1 in. pulley stiles, 1 in. face linings, and 1 in. return linings, tongued together and fixed to the outer face of the framing. Fit the shutter with two 3 in. brass flush sash lifts, and $1\frac{1}{4}$ in. shelf, 12 in. wide, with rounded nosing and small quadrant corners, extending to the inside of the framing. Support this shelf by two $1\frac{1}{4}$ in. by 9 in. by 9 in. shaped brackets housed to the framing and shelf.

Line the wall at back of lift with $\frac{3}{4}$ in. matched and

beaded boarding, in 7 in. widths on 3 in. by 1 in. grounds, plugged to the brickwork.

Shelf for Gas Meter. 379. Supply $1\frac{1}{4}$ in. shelf for gas meter, and fix it where directed with the necessary bearers or brackets.

Bell Boards. 380. Supply $1\frac{1}{4}$ in. beaded bell boards for 25 bells in all, and fix them in four places.

Enclosure of Luggage Lift. 381. Enclose the luggage lift from floor of basement to ceiling of third floor with $1\frac{1}{2}$ in. square framing where the adjacent doors are square framed and moulded and square where they are moulded. Tongue and staff-bead the salient angles of the framing. Form door opening in the basement and fit with $1\frac{1}{2}$ in. door, 2 ft. 9 in. by 6 ft. 9 in. four panel moulded and square, hung with $3\frac{1}{2}$ in. iron butts. Fit with 6 in. mortise lock and brass flush furniture on one side. Fit with 2 in. by $\frac{3}{4}$ in. deal beaded stop on ground, first, second, and third floors, form similar openings, each fitted with $1\frac{1}{2}$ in. two panel door, 2 ft. 9 in. high, hung and fitted as last. Fix over each of these doors $1\frac{1}{2}$ in. shutter, as described for dinner lift. Rebate the lower edge of shutter and the upper edge of door to fit each other.

Line the walls at back of lift with $\frac{3}{4}$ in. matched and beaded boarding, in 7 in. widths on 3 in. by 1 in. grounds, plugged to the brickwork.

Fittings in Spanish Mahogany—W.C. adjoining Garden Entrance. 382. Fit the w.c. adjoining the garden entrance in Spanish mahogany in all respects as described for the boudoir w.c. on the second floor.

W.C. and Lavatory adjoining Billiards, &c. 383. Fit the w.c. adjoining billiard room and the w.c. in cloak room with Bolding's No. 137 "Kenon" double wood balanced seat. Put at the back of the seat between the brackets 7 in. by 1 in. ovolo-moulded skirting.

Lavatory Enclosures. 384. Enclose the space beneath the lavatory adjoining the billiard room and that adjoining cloak room with $1\frac{1}{4}$ in. moulded and square framing, and fit to each $1\frac{1}{4}$ in. moulded and square two-panel door, hung with 3 in. brass butts. Fit with strong brass turnbuckle, with furniture to match the furniture of the doors adjacent.

Basement.

Windows in Deal. 385. Fit the whole of the basement windows with 4 in. by $3\frac{1}{2}$ in. rebated and ovolo-moulded frames, $4\frac{1}{2}$ in. by

$3\frac{1}{2}$ in. *oak*, sunk-weathered and check-throated sills, 2 in. moulded casements, with moulded bars. Fit the casements intended to open with 3 in. iron butts, 9 in. iron japanned slotted casement stays, and strong japanned iron cockspur fastenings. P. C. 6*d*. each.

Finish all around the inside of frame with $1\frac{1}{4}$ in. by $\frac{3}{4}$ in. chamfered fillet.

Doors in Deal. 386. The door of beer cellar to be 3 ft. 3 in. by 6 ft. 9 in., the remainder 3 ft. by 6 ft. 9 in. 2 in. deal, framed and braced, filled in with 1 in. beaded both sides, grooved and tongued boarding in 4 in. widths, hung with $3\frac{1}{2}$ in. iron butts to $4\frac{1}{2}$ in. by 3 in. rebated and beaded frames.

Fit the wine cellar door with a Hobbs's mortise dead lock. P. C. 20*s*. Fit the whole of the doors with strong Norfolk thumb latches. Finish around the frame on one side with $1\frac{1}{4}$ in. by $\frac{3}{4}$ in. chamfered fillet.

The door to rolling way to be 4 ft. by 7 ft., 2 in. framed and braced, hung to frame as before. Fit with a 9 in. and a 12 in. Tower bolt, and a 7 in. upright mortise dead lock. Finish inside with $1\frac{1}{4}$ in. by $\frac{3}{4}$ in. fillet, as last described.

Flaps and Barrel Slide. 387. Supply to rolling way, 2 in. oak cellar flaps, in 7 in. widths, grooved and tongued with $1\frac{1}{4}$ in. galvanized hoop iron, and with 7 in. by 2 in. chamfered ledges, screwed on, hung folding with two pairs of strong wrought-iron strap hinges 24 in. long, each hinge bolted with four $\frac{1}{2}$ in bolts, and with fanged hooks let into the stone curb, and run with lead. Notch the curb for and supply as additional support 5 in. by 4 in. oak bearer. The whole of this work to be wrought.

Construct the barrel slide of two 9 in. by 3 in. sawn deal bearers, laid sloping, and each framed at bottom into a $4\frac{1}{2}$ in. by 4 in. sawn oak sleeper 3 ft. long, bedded in the floor.

Connect these bearers by three $\frac{3}{4}$ in. iron bolts, each passing through an 18 in. length of 1 in. wrought iron barrel as distance piece.

Staircases.—*See Notes, p.* 473.

Staircases in Deal. 388. All winders and landings to be cross-tongued.

All steps to be carefully housed and wedged to the strings, and notched and fitted in the best manner.

The handrails to be dowelled at the joints, and screwed with handrail screws.

Construct the staircase from second to third floor of $1\frac{1}{4}$ in. treads with rounded nosings, with small moulding, rebated and tongued under, and 1 in. risers, all rebated and screwed together, and glued, blocked, and bracketed on strong fir carriages, $1\frac{1}{4}$ in. hollow-moulded wall string, $1\frac{1}{2}$ in. outer string, grooved and three times hollow-moulded.

4 in. by 4 in. fir newels, four times hollow moulded, $1\frac{1}{2}$ in. girth, with moulded stops ; 4 in. by 3 in. newels next walls, twice moulded, to match last. Where possible, bring the newels below landings, and cut and turn the ends to form pendants about 9 in. long. Finish tops of newels with cut and turned octagonal finials with polished oak balls, with strong oak pin let in and glued, and moulded stops to moulding, all to design.

$2\frac{1}{2}$ in. by $4\frac{1}{2}$ in. wainscot, moulded handrail, and $1\frac{1}{2}$ in. deal turned balusters, two to each step, housed to string and handrail.

Staircase in Oak.

389. Construct the staircase from ground to second floor, 4 ft. between the strings, of $1\frac{1}{4}$ in. treads with moulded nosings, and 1 by $1\frac{1}{4}$ in. moulding, rebated and let in, and 1 in. risers, all rebated and grooved together, glued, blocked, bracketed, and screwed together, on three strong fir carriages, housed to $1\frac{1}{2}$ in. wall string, with 3 in. by 2 in. moulding as capping, tongued on. The landings to be $1\frac{1}{4}$ in. in 3 in. widths. The outer string to be $1\frac{1}{2}$ in. with 3 in. by $1\frac{1}{2}$ in. capping, moulded both edges, and $1\frac{1}{2}$ in. by 1 in. rebated bed moulding. Fix to the outer face of the string $1\frac{1}{2}$ in. by 2 in. moulding, rebated on back edge, and let in. The outer string, with its capping and mouldings, to be continued along face of landings as apron.

The newels to be 5 in. by 5 in., square turned, grooved, and moulded to design, with pendants brought below the soffits. The finials and pendants to be cut and turned separately, and fixed and glued to the newel with $1\frac{1}{2}$ pins turned on.

The handrail to be moulded 4 in. by 3 in. The balusters to be 2 in. by 2 in., square turned and grooved, with chamfered caps and bases with moulded stops, and to be housed to the string and handrail.

The bottom step to have a semicircular end and veneered front to the riser, and the curved parts of the string to be veneered in the best manner.

Balustrade to the Best Staircase. Fit the stone staircase with wrought-iron baluster panels to design, P. C. 25*s*. each, exclusive of fixing, the points let into the stone and run with lead, and riveted to 2 in. by $\frac{3}{8}$ in. wrought iron core rail screwed to the wooden rail, with screws with countersunk heads. Fit with $3\frac{1}{2}$ in. by $2\frac{1}{2}$ in. Spanish mahogany moulded handrail grooved for the core rail.

Handrail to Basement Stairs. 391. The handrail to basement stairs to be 3 in. by 2 in. of oak, moulded and French polished, fixed to wrought-iron brackets, 3 ft. apart, with fanged ends, built into the brickwork, and with flanged tops and countersunk holes, each screwed with two screws to the handrail.

FOUNDER AND SMITH.—*See Notes, p.* 478.

Quality. 392. All the cast and wrought ironwork to be of the best quality.

Or,

> The wrought iron to be equal in quality to the best Staffordshire, and capable of bearing a tensile strain of 22 tons per square inch of sectional area before fracture, and a cross-strain of 11 tons without permanent set.
>
> The castings to be made of strong grey No. 3 pig-iron, cast from second melting.

Bolts. 393. All the bolts to be of wrought iron, each to have a head, nut, and washer; the threads to be Whitworth threads, and the nuts to fit properly.

Testing. 394. The ironwork shall be subjected to a test not exceeding half the breaking-weight, at the contractor's expense, and the contractor shall replace any defective piece of ironwork with new.

Lengths and Weights of Girders and Joists. 395. The lengths of the girders and joists are believed to be correct, but contractor to be responsible for their accuracy. The weights are taken from Messrs. Measure's trade list, and the contractor to pay for any extra weight charged as rolling margin without extra charge.

List of Steel Joists.

396. Supply and fix in positions, and of sizes and weights as follows, rolled steel joists of the best manufacture:—

To support the wall over dining-room bay, two joists 8 in. by 4 in., weight 22 lbs. per foot run, and 13 ft. long.

To support the main external wall over kitchen, two joists 10 in. by 5 in., weight 36 lbs. per foot run, and 16 ft. long.

To receive the concrete of floor over basement 10 joists 7 in. by $2\frac{1}{4}$ in., 15 lbs. per foot run, and 12 ft. long, &c.

Cast Iron.

Stanchions.

397. The stanchions to front to be 12 in. by 8 in., of $1\frac{1}{4}$ in. metal of **I** section, with two stiffeners in the height, square caps and bases, with two stubs to base, let into the stone base, and each of the caps secured to girder above by two $\frac{3}{4}$ in. bolts 4 in. long, with heads and nuts.

Columns.

398. The two iron columns on ground floor to be hollow, of 1 in. metal, and 8 in. external diameter, with plain caps and bases, 12 in. by 12 in. The bases to have two 1 in. by 1 in. stubs, and the caps to have 1 in. brackets, four to each column. Bolt each cap to the girder above with two 4 in. by $\frac{1}{2}$ in. coach screws.

Eaves-Gutters. *See Notes, p.* 486.

399. Put to eaves of lamp room roof 4 in., half-round eaves-gutter, bolted, and jointed in red-lead cement, and fixed with wrought-iron brackets, screwed to the feet of rafters, supply all requisite stopped ends, angles, outlets, &c.

Put to all other eaves Macfarlane's (Glasgow) No. 23 4 in. by 3 in. moulded eaves-gutter, bolted together, jointed with red-lead cement, and fixed with stout screws to fascias. Supply all necessary stopped ends, angles, outlets, &c.

Rain-water Pipes. *See Notes, p.* 486.

400. The rain-water pipes to lamp room roof to be 3 in. cast iron, with eaves cast on, and fixed with wrought-iron rose-head nails.

All the other rain-water pipes to be Macfarlane's 4 in. by 3 in., with moulded collars and loose ears, No. 28, fixed with wrought-iron nails to oak plugs in the brickwork, all to discharge with shoes over surface gulleys. (See "Drains.")

Supply all necessary angles, swan-necks, plinth-bends, &c.

Fix, where directed, two Macfarlane's heads. List Price, 12*s*. each.

Ranges and Stoves. See "Provisions." *See Notes, p.* 491.

401. Supply for kitchen a range with boilers, P. C. £28; for scullery a range, P. C. £4; for still room a range, P. C. £4; for dining and drawing-rooms dog stoves, P. C. £15 each; for hall a dog stove, P. C. £7; for billiard room a dog stove, P. C. £10.

For bedrooms Nos. 1, 2, 3, 4, slow-combustion stoves. P. C. £4 each.

For bedrooms Nos. 5, 6, 7, 8, 10, slow-combustion stoves. P. C. £2 each.

Copper.

402. Supply in scullery a 30-gallon copper furnace pan of the best town manufacture, well hammered and riveted, weight not less than 70 lbs., and iron furnace work.

Wrought Iron.—*See Notes, p.* 482.

Guard Bars.

403. The guard bars to kitchen window to be framed, and the whole height of frame, $\frac{3}{4}$ in. diameter, and 6 in. from centre to centre; two horizontal rails, 2 in. by $\frac{1}{2}$ in., both bars and rails to be forged and screwed to inside of frame with $1\frac{1}{2}$ in. stout screws, the heads countersunk.

Balustrades.

404. The balustrade of steps to back entrance to be of 2 in. by $\frac{5}{8}$ in. oval handrail with 'down scroll' at bottom, and riveted to $\frac{5}{8}$ in. square balusters and $1\frac{1}{4}$ in. square newel, all mortised to the stone, and run with lead.

Construct the balustrade of main staircase of $\frac{3}{4}$ in. by $\frac{3}{4}$ in. balusters, two to each step, and $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. newel framed to 2 in. by $\frac{1}{4}$ in. core rail, screwed to the oak handrail, the heads of the screws countersunk. Let in the ends of the balusters and newel to the steps and landings and run with lead.

Scrapers.

405. Supply at two entrances $\frac{1}{2}$ in. by 2 in. galvanized iron bar, 2 in. longer than the width of the recess (see detail No. 20) let in to the stone at each end and run with lead.

Dinner Lift.

406. Supply between basement and ground floor a single hand-power dinner lift to raise 56 lbs., space in box 2 ft. by 2 ft. and 2 ft. 3 in. high, including box with two shelves, weight, hauling wheel, best Manilla rope, silent guides and runners, brake gear, and india-rubber buffer stops.

Luggage Lift.

407. Supply a luggage lift to raise $1\frac{1}{2}$ cwt. from the basement to the third floor with spur wheel and pinion

gear, with gun-metal bushes, stout Manilla rope of the best quality to suit shaft 3 ft. square, balance weight and efficient brake, box of $1\frac{1}{4}$ in. wrought oak, 4 ft. high chain indicator and discs; and sound and well-seasoned deal guides.

Iron Stages and Ladders. 408. Fix to one side of the central chimney stack for its whole length and 21 in. wide a platform of $\frac{5}{16}$ths chequered plates, with close planed joints set in red-lead cement, drilled with counter-sunk holes and fixed with $\frac{1}{4}$ in. by $2\frac{1}{4}$ in. stove bolts 6 in. apart to three riveted brackets of 3 in. by 3 in. by $\frac{1}{2}$ in. rolled steel T 21 in. by 24 in., as Fig. 22, the top member passing completely through the stack, forged, split and turned up and down 6 in. Form a balustrade 2 ft. 9 in. high to one side and end at each salient angle of the platform, and 2 ft. apart fix a $\frac{5}{8}$ in. by $1\frac{1}{2}$ in. wrought-iron standard, the top forged as eye, the lower end shouldered and forged as $\frac{3}{4}$ in. bolt, passing through the plate iron for a length of $1\frac{1}{2}$ in. and fitted with a large nut, those occurring over the brackets to pass through them also. Fix $\frac{3}{4}$ in. steam tubing as rail, and pin it into the brickwork at ends.

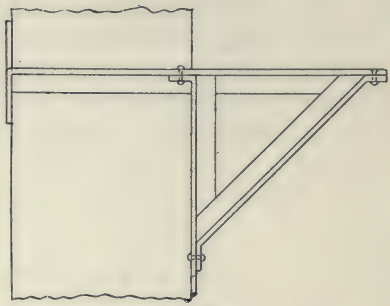

FIG. 22.

Supply a wrought-iron ladder 21 in. wide of $2\frac{1}{2}$ in. by $\frac{1}{2}$ in. sides and $\frac{5}{8}$ in. diameter rounds, about 9 in. apart from lead flat up to platform. The upper end of each of the ladder sides bolted with two $\frac{1}{2}$ in. bolts to the platform, the lower end bolted with two $1\frac{1}{2}$ in. coach screws to the timbers of the flat and bedded in red lead.

Snow Guards. 409. Supply to eaves of roofs over conservatory and over skylights of roofs at a lower level snow guards of 20 gauge galvanized wire netting $\frac{1}{2}$ in. mesh and 12 in. high, tied with stout galvanized iron wire to $\frac{1}{2}$ in. by $\frac{3}{8}$ in. galvanized wrought iron standards flanged and screwed to the roof timbers and 2 ft. apart.

Area Grating. 410. Supply grating to area of south-eastern cellar of $\frac{1}{2}$ in. by $1\frac{1}{2}$ in. frame with four lugs 6 in. long, and bars

$1\frac{1}{2}$ in. by $\frac{3}{8}$ in. and $2\frac{1}{2}$ in. apart. Let the lugs in flush to the curb and run them with sulphur.

Provision of Straps and Bolts. 411. Provide 5 cwt. of wrought iron in straps and bolts and fixing to roofs to be used as directed, or deducted if not required.

GASFITTER (ALL AS PROVISION.)—*See Notes, p.* 494.

Pipes. 412. The pipes to be Russell's patent wrought-iron welded tubing, with all necessary bends, tees, angles, and connections, and jointed in red-lead cement.

Provide the following lengths of pipes and fixing:—400 ft. $\frac{1}{2}$ in. pipe, 60 ft. $\frac{3}{4}$ in. pipe, and 70 ft. 1 in. pipe.

Or,

Carry 1 in. pipe from the meter to the level of the first floor, thence carry $\frac{3}{4}$ in. pipe to the level of the third floor. From the rising main at the level of the third and first floor carry $\frac{3}{4}$ in. pipe across floor as far as opposite to the furthest point but one, from the $\frac{3}{4}$ in. pipe at third floor level, rise with $\frac{1}{2}$ in. pipe to third floor, and drop to second floor points. From the $\frac{3}{4}$ in. pipe at first floor level rise to first floor points and drop to ground floor points. From the rising main take $\frac{1}{2}$ in. pipe to supply all the basement points.

Fittings. 413. Fix the fittings supplied, ten brackets and three pendants (see Provision), supplying all nipples, an iron ceiling plate for each pendant, and a mahogany rose for each bracket.

Or,

Supply and fix the following fittings, including an approved ceiling plate for each pendant, and a French-polished mahogany rose for each bracket.

The fittings to be made by Evered & Co., Drury Lane, W.C.; the numbers in trade list and intended positions are as follows, and marked thus on plans + or × :—

First floor—

	Diameter.	
Bedrooms 1, 2, 3 and 4 . .	$\frac{5}{8}$ in.	No. 1034
,, 5, 6, 7 and 8 . .	$\frac{5}{8} \times \frac{1}{2}$ in. .	No. 2873
Corridor (2)	$\frac{5}{8}$ in.	No. 2791

&c., &c.

Gas Meter. 414. Supply a Glover's patent dry gas meter for 50 lights, pay charges for getting it inspected and stamped, and fix it.

Connect Meter. 415. Supply short length of 1 in. strong lead pipe and brass connections, and connect main with meter.

Main Cock. 416. Fix where directed 1 in. brass gas-main cock.

Carnaby's Gas Regulator. 417. Fix where directed a Carnaby's patent No. 5 1 in. gas regulator.

Stop-cocks. 418. Fix where directed three $\frac{3}{4}$ in. brass strong polished stop-cocks with unions at each end.

Attendance, &c. 419. Give notice to gas company, and pay any charges for bringing gas-pipes, up to building, test pipes, and leave perfect at completion, attend upon, cut away for, and make good after gasfitter in all trades, and make good roads and footways to the satisfaction of the local authorities.

BELLHANGER.

Bells and Fittings. 420. The bells to be 12 oz. bells (averaged), of various tones, hung with best well-stretched copper wire in concealed zinc tubing, with steel springs, cranks, pendulums and indicators, and with iron boxes and mouthpieces to pulls.

Supply the following bells and pulls :—

Second floor—

Bedroom 3 . . .	One bell with one lever pull to ring in kitchen.
,, 4 . . .	One bell with one ceiling pull to ring in kitchen.
,, 5 . . .	One bell with one ceiling pull to ring in kitchen.
	One bell with one ceiling pull to ring in bedroom 1.

First floor—

Bedroom 6 . . .	One bell with one ceiling pull to ring in bedroom 2.
	One bell with lever pull to ring in kitchen.
,, 7 . . .	One bell with two ceiling pulls to ring in kitchen.
,, 8 . . .	One bell with one lever pull to ring in kitchen.

First floor—continued.

Bells and Fittings.

Bathroom . . .	One bell with one lever pull to ring in kitchen.
Boudoir	One bell with one lever pull to ring in kitchen.
	One bell with one lever pull to ring in bedroom 2.
Landing	One bell with one lever pull to ring in bedroom 1.
Ground floor—	
Drawing-room . .	One bell with two lever pulls to ring in kitchen.
Dining-room . .	One bell with one lever pull to ring in kitchen.
	One bell with one lever pull to ring in bedroom 1.
Library	One bell with one lever pull to ring in kitchen.
	One bell with one lever pull to ring in harness-room.
Billiard room . .	One bell with one lever pull to ring in kitchen.
Hall	One bell with one lever pull to ring on second floor landing.
Principal entrance .	One bell with sunk plate pull to ring in kitchen.
Trade entrance . .	One bell with sunk plate pull to ring in kitchen.

Pulls. 421. Fix the pulls provided. (See Provisions.)

Speaking Tube. 422. Connect the library with the housekeeper's room by a speaking tube of $\frac{3}{4}$ in. stout composition pipe with brass connections, and at each end 2 ft. of silk-covered flexible tube, ebony oval mouthpiece and whistle, 9 in. by $\frac{3}{4}$ in. by 7 in. mahogany French polished board, ovolo moulded on all edges, and two brass hooks.

ELECTRIC BELLS.

Quality. 423. The bells to be electric, the wires to be No. 20 B.W.G. copper of best quality, insulated with gutta-percha, double-covered with cotton, and afterwards varnished, and

to be concealed in zinc tubes. The buttons to have china roses, ebonite backs, and German-silver springs with platinum contacts.

The pear presses to be of hard wood, polished, with German-silver springs and platinum contacts, and each to have 9 ft. of flexible silk cord and a stout hard wood rosette, polished.

The bells and indicators to be in $\frac{7}{8}$ in. Spanish mahogany cases of the best quality, French polished; every bell which is connected with more than one room to have an indicator.

The battery to be Leclanché, or other approved, and sufficiently powerful and efficient.

The whole to be fixed in the best manner, and left in working order.

The following fittings are to be supplied and fixed. The prices are gross list prices from Messrs. catalogue.

List of Fittings and Bells.

424. *Ground Floor—*

		s.	d.
Principal entrance .	One $4\frac{1}{2}$ in. bronzed press at .	10	6
Trade entrance .	One $3\frac{1}{2}$ in. ,, ,, .	8	6
Study . . .	One 3 in. china button at .	2	6
Dining-room . .	,, ,, ,, .	2	6
Drawing-room .	,, ,, ,, .	2	6
Morning-room .	,, ,, ,, .	2	6
(To ring and indicate in kitchen with $2\frac{1}{2}$ in. bell.)			
Hall . . .	One 3 in. china button at .	2	6
First-floor landing .	,, ,, ,, .	2	6
(To ring and indicate on second-floor landing with $2\frac{1}{2}$ in. bell.)			

First Floor—

Room 4 . . .	One pear press at . . .	6	6
(To ring and indicate in room 16, second floor, with $2\frac{1}{2}$ in. bell.)			
Room 4 . . .	One pear press at . . .	6	6
(To ring and indicate in kitchen with $2\frac{1}{2}$ in. bell.)			
Room 5 . . .	One pear press at . . .	6	6
(To ring and indicate in room 16, second floor, with $2\frac{1}{2}$ in. bell.)			
Room 6 . . .	One 3 in. china button at .	3	0

		s.	d.
First floor—continued.			
Room 8 . . .	One 3 in. china button at .	3	0
,, 10 . . .	,, ,, ,, .	3	0
,, 11 . . .	,, ,, ,, .	3	0

(To ring and indicate in kitchen with $2\frac{1}{2}$ in. bell.)

Supply switch connection inside front entrance to transfer current from kitchen bell to bell on second-floor landing.

Cutting away and Casings. 425. Cut away for and make good to the electric bell system in all trades; fix floors and joinery over wires with brass cups and screws to remove, and supply all necessary wooden casings for wires which would otherwise be exposed.

PLUMBER.—*See Notes, p.* 504.

Materials. 426. The whole of the sheet lead to be the best milled lead of uniform thickness, laid without solder, and to weigh the weight specified.

Supply all labour. Solder joints, wall hooks, copper nailing, &c., necessary to complete.

Weighing. 427. The contractor shall furnish adequate proof of the weight and quality of all materials used, shall weigh such pieces of the lead as the architect may require, and shall keep scales and weights on the ground for that purpose.

Wire Covers. 428. Put to all rain-water heads, cesspools, and outlets of eaves-gutters, strong copper wire covers.

Flashings. 429. Where the lead turns up against vertical faces put flashings of 5 lbs. lead 6 in. wide, the laps to be 4 in.

Stepped Flashings. 430. Up rakes of roof where they adjoin vertical faces put stepped flashing of 5 lbs. lead 12 in. wide with 3 in. laps.

Aprons. 431. To all chimneys and other vertical faces where the slope of roof runs up to them, put aprons 12 in. wide of 5 lbs. lead with 3 in. laps.

Lead Wedging. 432. All flashings and aprons to be secured by lead wedging.

Valleys. 433. Lay the valleys with 6 lbs. lead 18 in. wide with 3 in. laps.

Hips. 434. Cover the hips and ridges with 6 lbs. lead 18 in. wide with 4 in. laps.

Soakers. 435. Where ridges run into slopes of higher roofs put soakers 18 in. by 18 in. of 5 lbs. lead.

Up rakes of roofs where they adjoin vertical faces put soakers of 5 lbs. lead 8 in. wide and equal in length to the total length of a gauge and a lap, with a stepped flashing of 5 lbs. lead 6 in. wide.

Flashing to Iron through Slating. 436. Fix to each rod of the iron stays for pipes, to the standards of snow guards, and to all iron pipes passing through roof a lead slate 12 in. by 10 in., with a 6 in. length of strong lead pipe soldered thereto of sufficient size to allow the pipe or stay to pass through, and to bed it in white lead.

Gutters. 437. Lay the gutters with 7 lbs. lead to turn up against vertical faces 6 in. and up slope of roof 10 in., measured from the sole of the gutter. None to be less than 10 in. wide at the narrowest part.

Behind all skylights and chimneys and in similar positions put gutters as last, but of an average width of 6 in.

Cesspools. 438. Line the cesspools with 7 lbs. lead and convey the water thence into the rain-water pipes by lengths of 3 in. drawn lead pipe, bent as required, and tafted and soldered to the cesspool.

Rain-water Pipes. 439. Take the water from roofs by 4 in. drawn lead pipes weighing 9 lbs. per foot run, with astragals and cast-lead ornamental ears about every 3 ft. in length, and fixed with large wrought-iron nails with rose heads to teak plugs in the brickwork.

Supply four cast-lead ornamental heads to design, P. C. £5 each, and fix them.

Hip Knobs. 440. Cover the two hip knobs with 8 lbs. lead, dressed and bossed out of solid without soldering, and corrugate the lower edge of the lead to design.

Dormer of Room 16. 441. Cover the cheeks of this dormer with 6 lbs. lead, the front edges to be closely copper nailed and welted. Put up rake of roof along bottom edge of cheek a flashing of 5 lbs. lead 12 in. wide, turned up under the lead of the cheek. To the sill put an apron of 5 lbs. lead 15 in. wide. Put two soldered dots to each cheek with stout 1½ in. brass screw to each.

Lantern over Billiard Room. 442. Cover the ridge and hips of this lantern with 6 lbs. lead 15 in. wide with 4 in. laps. Carefully dress the edges of the lead over the glass.

Flash the curb with 5 lbs. lead to lay 6 in. on the slope of roof, turned up and over the curb, carried to the back of the sill turned up $1\frac{1}{2}$ in. in a rebate prepared for it, the edge bedded in white lead, and closely copper nailed.

Skylight over Cistern Room. 443. Put gutter behind this skylight as before described, with flashing of 5 lbs. lead 15 in. wide, and flash the other three sides of curb with 5 lbs. lead 18 in. wide.

Trap. 444. Cover the trap with 6 lbs. lead bossed at angles, turned over the rims and 1 in. beyond the inner edges thereof, and closely copper nailed.

Flash the curb with 5 lbs. lead 21 in. wide, the edge closely copper nailed.

Lead Flat. 445. Cover the flat with 7 lbs. lead carefully dressed to rolls, the lead of the undercloak to cover $\frac{2}{3}$rds of the roll, the overcloak to lay $1\frac{1}{2}$ in. on the flat.

INTERNALLY.—*See Notes, p. 508.*

Quality. 446. The whole of the materials to be of the best quality obtainable.

Cuttings. 447. The contractor shall supply the architect with cuttings of the lead pipes of reasonable lengths, so that he may test their weight.

Soldered Joints. 448. All the joints shall be wiped joints, made in the best manner with solder of the best quality. No joints shall occur in the thickness of the wall.

The wiped joints to be of the following lengths:—

4 in. pipes,	$3\frac{1}{2}$ in.	$1\frac{1}{2}$ in. pipes,	3 in.	$\frac{3}{4}$ in. pipes,	$2\frac{3}{4}$ in.
3 in. ,,	$3\frac{1}{2}$ in.	$1\frac{1}{4}$ in. ,,	3 in.	$\frac{1}{2}$ in. ,,	$2\frac{1}{2}$ in.
2 in. ,,	$3\frac{1}{4}$ in.	1 in. ,,	3 in.		

The wiped joints to brass or other fittings to be of extra strength.

Bends. 449. All bends to have wide sweeps, the bore of the pipe to be kept full size throughout, and the lead of uniform thickness. Dummies and not bobbins and followers to be used where possible in forming bends, and each bend shall be tested by passing a ball through it.

The bends to the pipes 2 in. in diameter and under shall be fire bends.

Lay Pipes in Straight Lines. 450. All pipes shall be laid in straight lines, avoiding syphons, and shall all fall towards the rising main.

Pipes outside the building shall be laid not less than 2 ft. underground.

Tacks and Collars. 451. All pipes, without exception, to have tacks, and no pipes to have collars.

The tacks to soil pipes to be of cast lead, about 3 ft. 4 in. from centre to centre and $9\frac{1}{2}$ in. high, each pair to weigh 8 lbs. Each tack to be soldered on separately, and fixed with two 4 in. gun-metal nails, with flat stems and large heads, driven into stout teak plugs in the wall.

The weight of the tacks for smaller pipes to bear the same relation to the weight of the pipes as the foregoing.

Protect Pipes. 452. Wrap those service pipes which are exposed to frost in Croggon's matted felt, bound on with copper wire.

Secure Pipes to Roof Timbers. 453. Where the pipes run up beneath slopes of roofs deal blocks shall be carefully fitted between the rafters, at the distances apart necessary to receive the tacks, and screwed with stout screws to the rafters. These blocks shall be 10 in. wide and 3 in. thick, and the tacks shall be secured to them by 3 in. stout brass screws instead of the nails before mentioned.

Finish of the Tops of Soil and Ventilating Pipes. 454. Finish the tops of soil and ventilating pipes with beaded edges and slots 12 in. long and $\frac{3}{8}$ in. wide, four to each pipe. Solder into the top of each pipe stout upper cross-wires, as Fig. 23.

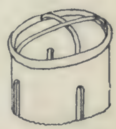

FIG. 23.

Iron Stays. 455. The lead pipes which stand above roof shall be stayed by $\frac{1}{2}$ in. diameter wrought-iron rods, secured to the pipe by a wrought-iron collar $1\frac{1}{2}$ in. by $\frac{3}{8}$ in., riveted to the stay. The lower end of the stay shall pass through the slating, shall be forged as flange, and screwed to a deal block, as before described, with two stout screws.

Weight of Pipes. 456. The lead pipes to be best drawn lead pipes of the weights as follows:—

Service Pipes—

$\frac{1}{2}$ in.	diameter,	6 lbs.	per yard.
$\frac{3}{4}$ in.	,,	9	,,
1 in.	,,	12	,,
$1\frac{1}{4}$ in.	,,	16	,,
$1\frac{1}{2}$ in.	,,	19	,,

Waste, Ventilating, and Anti-syphonage Pipes—

$1\frac{1}{4}$ in.	diameter,	9 lbs.	per yard.
$1\frac{1}{2}$ in.	,,	15	,,
2 in.	,,	18	,,
$2\frac{1}{2}$ in.	,,	24	,,

Soil Pipes—

3 in.	diameter,	$6\frac{6}{10}$ lbs.	per foot.
$3\frac{1}{2}$ in.	,,	$7\frac{6}{10}$	,,
4 in.	,,	$8\frac{7}{10}$	,,

Taps. 457. The bib-taps to be extra strong gun-metal, Lord Kelvin's patent, with screw bosses, and engraved "Cold."

Stop-cocks. 458. The stop-cocks to be similar to those last described, and to have a gun-metal union at each end.

Labels. 459. Fix near to every stop-cock an enamelled iron approved label, specially lettered, as may be directed.

Traps. 460. All traps under sinks, w.c.'s, lavatories, baths, &c., to be Du Bois traps, of the same diameter and weight as the pipes, and each to have a brass screw cap of the same diameter as the pipes.

All traps to have their mouths opened out to the size of the washer rim or grate to which they are fixed.

All traps shall be fixed immediately under the fittings without any intervening pipe.

Flap Valves. 461. All overflows shall have heavy brass weighted flap valves, with sockets, soldered into the pipes.

Arrangement for Testing. 462. Open the mouth of the trap under each w.c. apparatus and solder therein a heavy gun-metal socket, of bore equal to that of soil pipe, with flange 3 in. wide, screwed to receive a solid gun-metal screw plug to fit, and to be used for occasional testing. The safes to be dished to allow of an extra soldered joint of each socket to the safe.

Each soil pipe shall be plugged as directed after the traps for the w.c.'s and the anti-syphonage pipes are fixed, and filled with water, when if not found to be perfectly watertight it shall be made so.

Connections of Soil Pipes with Drain. 463. Connect each soil pipe with drain by a heavy brass thimble, soldered on and sealed down with cement.

Anti-Syphonage to W.C. 464. Wherever more than one w.c. or slop sink enters the same soil pipe, supply a $2\frac{1}{2}$ in. anti-syphonage pipe, carried

from the branch, receiving the trap of the lowest w.c. to a point in the vertical soil pipe just above the branch, which enters the soil pipe from the w.c. at the highest level. Take from the branch from any intermediate w.c. a similar $2\frac{1}{2}$ in. pipe into the anti-syphonage pipe before described.

Anti-Syphonage to Sinks. 465. Where more than one sink enters a vertical pipe they shall be fitted with an anti-syphonage pipe as described for the w.c., but $1\frac{1}{2}$ in. diameter only.

From the top of the trap of each sink, which has no other sink on the same waste pipe, carry a 2 in. anti-syphonage pipe sloping upwards through the wall, and finished on the outer face of wall with a 2 in. heavy brass cobweb grating soldered in.

Safes. 466. Lay under each cistern for its whole area 5 lbs. lead as safe, dressed over the splayed fillets and closely copper nailed.

Lay similar safes beneath each w.c. and bath above ground floor, dressed as before, and turned up against brickwork 4 in.

Put to each safe a 2 in. brass grate with rim soldered in, and carry therefrom through the external walls $1\frac{1}{4}$ in. lead pipe to deliver in the open air.

Cisterns. 467. (A) Supply in tower a galvanized wrought-iron riveted cistern, 6 ft. by 4 ft. by 4 ft. of $\frac{1}{8}$ in. plate, with angle iron around top, bottom, and angles, and four iron cross-stays and all necessary perforations for supplies and wastes. Fit with $1\frac{1}{2}$ in. brass washer and waste, with fly-nut and union, and a length of $1\frac{1}{4}$ in. middling lead pipe soldered on, and the end soldered up as handle for emptying. $1\frac{1}{2}$ in. waste to deliver on flat west of scullery. With 1 in. brass cistern connector and 1 in. lead pipe carry the overflow to deliver over the same flat.

(B) Supply in cistern-room a similar cistern to last, but 5 ft. 1 in. by 3 ft. 1 in. by 2 ft. 9 in., or to hold 250 gallons, and all as last described, except that the waste shall be carried through the north wall of cistern room to deliver over rain-water head adjacent.

W.C.'s. 468. Fit the servants' w.c. on second floor with Bolding's No. 21 new pattern white pedestal w.c. apparatus in one piece of earthenware, connected by heavy brass thimble, soldered joint, and 3 in. lead soil pipe, with a $3\frac{1}{2}$ in. vertical

W.C.'s. soil pipe outside of wall, extending from drains to 2 ft. above the ridge of the main roof. Connect the apparatus by $1\frac{1}{4}$ in. lead pipe with Bolding's three-gallon "Tranquil" water-waste-preventing cistern on iron brackets, carry $\frac{3}{4}$ in. lead pipe through wall as overflow, fit the cistern with strong brass chain and porcelain handle.

Fit the w.c. adjoining boudoir with Dent & Hellyer's (Newcastle Street, Strand) patent "Optimus" No. 61 valve closet, with galvanized cast-iron waste-preventing cistern, stop valve, union for overflow, $\frac{3}{4}$ in. lead overflow taken through wall and cranks and strong copper wire, and their extra strong anti-D trap, with 3 in. branch soil pipe taken into $3\frac{1}{2}$ in. vertical pipe outside of wall, carried up from drain to 2 ft. above the eaves of main roof. Connect the cistern with the apparatus by $1\frac{1}{4}$ in. lead pipe.

Fit the ground floor w.c., adjoining billiard room, with Bolding's No. 22 new pattern white "Kenon" pedestal closet, with fixed slop top, in one piece of earthenware, connected by heavy brass thimble, soldered joints, and 3 in. lead soil pipe with the vertical pipe which receives second floor w.c. Connect the apparatus by $1\frac{1}{4}$ in. pipe with Bolding's three-gallon "Tranquil" waste-preventing cistern on iron brackets, carry $\frac{3}{4}$ in. lead pipe through wall as overflow. Fit cistern with strong brass chain and polished hard wood handle.

Put similar apparatus to that last described in cloak room w.c., but connected with the soil pipe from boudoir w.c.

Fit the w.c. adjoining garden entrance in all respects as described for boudoir w.c., connect by 3 in. lead pipe into a $3\frac{1}{2}$ in. vertical pipe, as before described, carried up from drain to 2 ft. above the top of adjacent chimney shaft.

Fit the housekeeper's w.c. with "Kenon" closet, &c., as last described, and connect with the soil pipe from the second-floor w.c.

Fit the w.c. adjoining kitchen entrance with Doulton's (Lambeth) ornamental stoneware combination closet and trap, No. 118 C, with 3 in. lead soil pipe carried into $3\frac{1}{2}$ in. vertical pipe carried up from drain to 3 ft. above eaves of main roof. Put deal hinged seat, Doulton's No. 59b waste-preventing cistern on iron brackets, and brass chain and pull, No. 111 $1\frac{1}{4}$ in. flushing pipe, and $\frac{3}{4}$ in. lead overflow to cistern.

Slop Sink. 469. Supply in housemaid's closet, first floor, a Tyler & Sons' (Newgate Street, London) "Warwick" slop sink, connect by 3 in. lead soil pipe to the vertical pipe from servants' w.c., second floor.

Lining to Housemaid's Sink. 470. Line the housemaid's sink on second floor with 7 lbs. lead, the edges turned over and closely copper nailed and bedded in white lead.

Fit with 2 in. brass washer and plug and strong brass chain, and 2 in. lead trap and 2 in. waste carried through wall to deliver over gulley at yard level.

Covering to Draining Boards. 471. Cover the draining boards with 8 lbs. lead carefully dressed into the grooves, turned under at the exposed edges of the boards, closely copper nailed and bedded at the edges in white lead, and turned up 3 in. against the flashing boards. For draining boards, see Joiner Clause, 377A.

Cover the flashing board with 5 lbs. lead, with 3 in. laps, turned over the upper edge of the board and nailed to the back with copper nails.

Lining to Sinks in Butler's Pantry. 472. Line the sinks in butler's pantry with 8 lbs. lead, the edges turned over, closely copper nailed and bedded in white lead. Fit with 2 in. butler's pantry washer plug and strong brass chain, 2 in. trap with brass cap and screw, and 2 in. lead waste, to deliver into gulley outside of wall.

Cover the draining boards with pewter, $3\frac{1}{2}$ lbs. per foot superficial, carefully dressed into the flutes and over the edges.

Flash with 5 lbs. lead as described for the last-mentioned sink.

Scullery Sink. 473. Supply and fix in scullery on two half-brick piers in best white glazed bricks, set and pointed in cement, a fire-clay enamelled kitchen sink, 42 in. by 24 in. by 7 in., outside measure. Fit with 3 in. brass rim and grate, the rim run with lead, 2 in. trap and 2 in. waste to deliver into gulley outside of wall.

Baths. 474. Fit the servants' bathroom on second floor with a full-sized enamelled porcelain bath, with rolled edge, of Rufford's best quality, supported on porcelain feet. Cut rebated hole in the bottom, and fit with 2 in. brass grated washer, with long union and fly-nut, and 2 in. lead waste carried through the external wall to deliver over the

Baths. rain-water head adjacent. Cut hole for overflow, fit with $1\frac{1}{4}$ in. brass grate with rim, and 1 in. lead pipe connected with waste.

Fit the best bathroom on second floor with an enamelled full-sized copper bath, P. C. £10, with 2 in. lead trap and 2 in. waste, to connect with a 2 in. lead vertical pipe outside of wall, carried up from gulley at ground level to a height of 3 ft. above eaves of main roof. Connect a 2 in. anti-syphonage pipe with the waste pipe close to the trap, and carry it with a rise into the vertical pipe. Connect the overflow with the trap by $1\frac{1}{2}$ in. lead pipe.

Supply a set of 1 in. silver-plated pedestal cocks, with ebony handles, ebony pull and plate, and quick waste and brass unions.

Supply in the bathroom on first floor a 6 ft. best quality enamelled dished-bottom copper-flanged bath and canopy, with silver-plated fittings, for hot and cold, shower, wave-spray, sitz-douche, sitz-spray, and plunge, copper quick waste, with standing overflow, engraved silver-plated index plate, 2 in. lead trap and 2 in. waste to deliver into a 2 in. vertical pipe, and all as described for best bath on second floor.

Lavatories. 475. Supply in cloak room and in lobby adjoining billiard room, Shanks's (46, Cannon Street, London) No. 33 patent lavatory, with table top, white with gold bands, with waste pull and hot and cold taps, all silver-plated, 2 in. trap and 2 in. lead waste to deliver over gulley in garden.

Supplies. 476. From cistern A with 1 in. brass cistern connector with fly nut and union and 1 in. lead pipe, lay on the water as far as ceiling of ground floor, thence with $\frac{3}{4}$ in. pipe lay on the water to the lavatory in billiard room, lobby, and in cloak room. From the nearest point of this $\frac{3}{4}$ in. supply with $\frac{1}{2}$ in pipe, lay on water to waste-preventing cisterns of the w.c. in cloak room, billiard room, lobby, and house-keeper's w.c., and w.c. adjoining garden entrance.

From the 1 in. pipe, first described with 1 in. pipe, lay on the water to the best bath on first and second floor respectively.

From the nearest of these supplies with $\frac{3}{4}$ in. pipe and $\frac{3}{4}$ inch bib-cocks, lay on to housemaid's sink and slop sink.

Supply to Hot Water System. 477. From cistern A with $1\frac{1}{4}$ in. brass cistern connector with fly-nut and union and $1\frac{1}{4}$ in. lead pipe lay on the water, to return A under the cylinder.

From cistern B with 1 in. brass cistern connector with fly-nut and union and 1 in. pipe lay on the water as far as ceiling of ground floor, thence with $\frac{3}{4}$ in. pipe and $\frac{3}{4}$ in. bib-cock lay on to scullery sink.

From the 1 in. pipe, last mentioned with 1 in. pipe and 1 in. bib-cock, lay on to servants' bath. From the nearest supply with $\frac{1}{2}$ in. pipe lay on the water to waste-preventing cisterns of servants' w.c., and w.c. adjoining boudoir.

From the nearest supply with $\frac{3}{4}$ in. pipe and $\frac{3}{4}$ in. bib-cocks, lay on the water to the sinks in the butler's pantry.

Rising Main. 478. From the company's main with 1 in. pipe and 1 in. high-pressure equilibrium ball valve with copper ball and stem lay on the water to cistern A.

From last pipe with $\frac{3}{4}$ in. pipe and $\frac{3}{4}$ in. similar ball valve lay on the water to cistern B.

Stop-cocks. 479. Fix in each separate supply, as near cistern as possible, a high-pressure screw down stop-cock, with unions at each end.

Fix, where directed, a similar stop-cock in the rising main and in the branch therefrom to cistern B.

Test Pipes. 480. Test the whole of the pipes and apparatus at completion.

Emptying Tap. 481. From the lowest point of rising main carry a $\frac{3}{4}$ in. pipe with $\frac{3}{4}$ in. bib-cock to deliver over a gulley in garden.

Connection with Main. 482. Connect with the water company's main or pay their charges for the work, and make good roads and footways to the satisfaction of the local authorities.

HOT-WATER SUPPLY.

Pipes. 483. The pipes to be Russell's best wrought-iron galvanized welded steam tubing with all necessary tees, bends, angles, and connections jointed with red-lead cement, and tested to a pressure of 500 lbs. per square inch.

All bends to be made before they are galvanized.

The pipes shall be fixed on the faces of the walls, and vertically, when possible, with as much rise to the flow pipe and fall to the return pipe as may be.

Cylinder. 484. Supply and fix on strong galvanized wrought-iron brackets to the eastern wall of the basement corridor near to kitchen range a galvanized wrought-iron hot-water cylinder to hold 100 gallons of $\frac{3}{16}$ in. plate with manhole carefully packed and bolted down, case with Croggon's (16, Upper Thames Street, London) matted felt, and $\frac{3}{4}$ in. deal wrought lagging secured by three polished brass hoops, 1 in. deal top and bottom, the whole fitted for easy removal.

Flows and Returns. 485. A. Connect the cylinder with the kitchen boiler by $1\frac{1}{2}$ in. flow and return.

B. Take from the cylinder $1\frac{1}{4}$ in. flow and return as far as the ceiling of housemaid's closet on second floor.

C. Take from the cylinder $1\frac{1}{4}$ in. flow and return as far as the ceiling of housemaid's closet on first floor.

From the flow pipe A with $\frac{3}{4}$ in. pipe and $\frac{3}{4}$ in. bib-cock lay on the water in corridor close to still room doorway.

From the flow pipe B with 1 in. pipe lay on the water to the two baths on second floor with 1 in. bib-cock to the porcelain bath.

From the flow pipe B with $\frac{3}{4}$ in. pipe and $\frac{3}{4}$ in. bib-cocks lay on the water to slop sink on first floor, housemaid's sinks on second floor, the butler's sinks, and scullery sinks.

From the flow pipe C with 1 in. pipe, lay on the water to the bath on the first floor.

From the flow pipe C with $\frac{3}{4}$ in. pipe, lay on the water to the two ground-floor lavatories.

Safety Valve. 486. Fix where directed an approved dead weight safety valve on pipe between the boiler and the cylinder.

Expansion Pipes. 487. Carry up from the highest point of each set of flows and returns $\frac{1}{2}$ in. expansion pipe to pass through roof, the pipe to pass through a short length of lead pipe soldered to a 5 lbs. lead slate. Bed the iron pipe with white lead therein.

Stop-cocks. 488. Supply extra strong gun-metal, engineer's pattern, quick turn full way stop-cocks, with unions at each end, in the following position :—One in each flow and return pipe above the cylinder ; one in flow and one in return between kitchen boiler and cylinder.

FIRE MAINS IN ALL TRADES.—*See Notes, p.* 528.

Materials. 489. The fire mains shall be supplied and fixed by Messrs. Merryweather & Sons (Greenwich Road), Messrs. Shand,

Mason & Co. (75, Upper Ground Street, S.E.), or other approved firm.

Quality. 490. All materials and workmanship shall be of the best quality and best London manufacture.

Pipes. 491. The pipes shall be 4 in. cast iron, each 9 ft. length, weighing 1 cwt. 1 qr. 21 lbs. They shall have sufficient sockets, shall be jointed with yarn, well caulked, and the socket completely filled with blue lead.

Dr. Smith's Composition. 492. Coat the whole of the pipes on the inside with Dr. Angus Smith's composition, and those laid underground both inside and outside. The buried pipes shall be 2 ft. underground.

Painting of Pipes and Fittings. 493. The exposed pipes and the ironwork of the fittings to have two coats of oxide of iron paint and two coats of oil colour.

Brackets and Clips for Pipes. 494. The horizontal pipes shall be supported on strong iron brackets, the vertical pipe by wrought-iron bolted saddle clips pinned into the wall.

Chamber for Sluice Valve. 495. Construct in the position shown on block plan (near the western lodge), on 6 in. of cement concrete extending 6 in. beyond the outer face of the brickwork all around, a pit 1 ft. 9 in. by 1 ft. 2 in. clear of half brickwork in cement, corbel out for and bed thereon a cast-iron hydrant box, $12\frac{5}{8}$ in. by $8\frac{5}{8}$ in. with chained cover. Lay two lengths of 4 in. by 3 in. steel joist across the pit, and fill in around the box with cement concrete 6 in. thick for a space 3 ft. 6 in. by 3 ft.

Sluice Valve. 496. Supply a sluice valve of best quality with four gun-metal faces, fitted into turned grooves with gun-metal screw and nut, the joints to be flanged and bolted with short spigot and faucet ends, the spindle of valve to be finished square and fitted with a loose iron T key.

Course of Pipes. 497. From the valve take the pipe to that point of the external wall where it is intended to carry up the rising main, the vertical pipe to start from the basement floor, and to be fitted with a cast-iron shoe.

Hydrants. 498. Carry the pipe up in the chase provided as far as necessary to admit of a hydrant on the fourth floor. On each floor supply a hydrant tee piece with screwed boss for hydrant, and another boss beneath it for bucket cock, and a hydrant, similar to Merryweather's No. 403, of polished

gun-metal, $2\frac{1}{2}$ in. outlet, with London Brigade thread, wheel, horizontal spindle, loose cap and chain. Fix under each hydrant a $\frac{3}{4}$ in. gun-metal bib-cock for buckets, with cap and chain, and screwed into a boss on the main pipe.

Pressure Gauge. 499. Supply a best quality hydraulic pressure gauge, with a highest pressure indicator, and locked dial face, and connect it to the rising main on ground floor with a short length of copper tube, fly-nut and union, and brass stop valve.

Hose. 500. Supply five 40 ft. lengths of $2\frac{1}{2}$ in. double-riveted leather fire hose, with polished copper branch pipe, with gun-metal nozzle and screw, gun-metal couplings to fit the hydrant, and polished hose and nozzle wrench.

Testing. 501. Test the whole system at completion to a pressure of 200 lbs. to the square inch, and leave perfect.

ZINC WORKER.

Quality and Laying of Zinc. 502. Lay the flats of main roof, bays, and flat over kitchen with No. 15 gauge, Vieille Montagne zinc, laid without soldering in the best known manner to a fall of 2 in. in 10 ft.

The zinc to turn up against vertical faces 6 in.

Where the zinc turns up against a vertical face put a flashing 6 in. wide with 4 in. laps.

Up the rakes adjoining cheeks of dormers put a flashing 12 in. wide with 3 in. laps.

Lay the gutters with similar zinc to turn up 10 in. under the slating measured from the sole of the gutter.

Cover the hips and valleys with similar zinc 18 in. wide.

Ornamental Zinc Work. 503. The following zinc work will be supplied and paid for by the building owner, who will deliver it at the building, the contractor to unload, store, protect, and fix it:—

The rolls and apron of curbs, the hips, except to tower, the cresting and finials of roof over northern entrance, the finials of the roof over cistern room, the complete covering of all the wooden dormers, and the ornamental fronts to the wooden gutters.

Eaves-gutters. 504. The eaves-gutters to be 4 in. ogee gutter of No. 13 gauge zinc, with stays of $\frac{1}{2}$ in. zinc tube 24 in. apart, and

fixed with stout screws to the fascia. Supply all necessary stopped ends, angles, and outlets, all of which may be soldered.

Rain-water Pipe. 505. The rain-water pipes to be 3 in. soldered pipe of No. 13 gauge zinc, with all necessary bends, shoes, and swan necks with tacks soldered on, and nailed with stout zinc nails to the brickwork.

Leave Perfect. 506. Clean out gutters, and leave the roofs perfect and weatherproof at completion.

PLASTERER.—*See Notes, p. 496.*

Sand. 507. The sand to be clean and sharp, free from all clay, loam, and other impurities, and to be washed if required, but for cement work it shall all be washed.

Laths. 508. The laths to be lath and half, rent out of best red Baltic wood free from sap, butted at joints, and nailed with wrought-iron nails, and the joints frequently broken.

Hair. 509. The hair to be the best long back hair, well beaten, and used in such quantities as the architect may direct.

Portland Cement. 510. The Portland cement to be from an approved manufacturer, and to weigh 112 lbs. per bushel, mixed 1 of cement to 3 of sand.

Keene's Cement. 511. The Keene's cement to be of approved manufacture on backings of coarse Keene's cement (or Portland).

Lime. 512. The lime to be fresh, well-burnt chalk lime, to be run into putty at least one month before being required for use.

Or,

The lime to be selenitic, and used in accordance with the company's instructions.

Finish. 513. The whole of the finished surfaces of the plastering shall be thoroughly flat.

The first coat of the plastering shall be carried down to the floors in all cases.

Whiten. 514. Twice whiten all ceilings and soffits.

Pugging. 515. Pug with lime, sand, and chopped hay, 2 in. thick, the whole of first and second floors.

Render and Set. 516. Render and set the walls of cistern-room.

Render, Float, and Set. 517. Render, float, and set all walls not otherwise described.

Lath, Plaster, Float, and Set. 518. Lath, plaster, float, and set all partitions, ceilings, and soffits of stairs and landings not otherwise described.

Metal Lathing. 519. Construct the scullery ceiling with Jhilmil patent metal lathing (Hayward Bros. & Eckstein, Union Street, Borough), securely fixed with wire nails and plaster, and set it.

Trowelled Stucco. 520. Finish the walls of kitchen in fine stucco finely trowelled to receive paint.

Fibrous Plaster. 521. The ceiling of billiard room to be of Jackson's (49, Rathbone Place, London) approved well-seasoned fibrous plaster screwed to the joists, with $1\frac{1}{4}$ in. galvanized iron screws, well stopped with approved patent stopping, and finished with a thin coat of Keene's cement. Supply an enriched cornice to this room in Jackson's fibrous plaster (P. C. 4*s*. per foot run), fix on the necessary bracketing, and carefully stop with approved patent stopping.

Cut out Cracks and Blisters. 522. Cut out all cracks and blisters, make good with fine plaster-of-Paris, and leave perfect at completion.

Fine Plaster.

Girths. 523. The girths described for mouldings are the finished girths without screeds. All enrichments to include modelling.

Cornices. 524. Run fine plaster cornices moulded 6 in. girth in rooms 1, 2, and 3, 12 in. girth in rooms 7, 8, 9, and 10, and principal corridor, first floor.

Enrichments. 525. The 12 in. cornices to have one enrichment, 3 in. girth, to design.

Ribbed Ceiling. 526. Set out the ceiling of dining-room in geometrical pattern to detail, cut away for and run ribs $1\frac{3}{4}$ in. wide and twice moulded 1 in. girth to mitre with topmost member of cornice. The plastering of the plain parts of this ceiling to be mixed with a special quantity of hair in following proportion—$2\frac{1}{2}$ yds. of sand, 40 bushels of lime, 1 cwt. of hair.

Portland Cement.

Skirtings. 527. Run $\frac{3}{4}$ in. by 7 in. square skirting, trowelled to receive paint, in kitchen, scullery, larder, and boots.

Window Backs. 528. Render and float $\frac{3}{4}$ in. thick behind all window backs.

Scullery Sink. 529. Render, float, and trowel for a height of 2 ft. to back and ends of scullery sink. Finish the edges with a flush bead and two quirks 2 in. girth in all.

Walls of Safe. 530. Render and float the walls and arch of safe.

Screed for Pavings. 531. Float $\frac{3}{4}$ in. thick the surface of all concrete to receive tile or mosaic pavings.

Screed for Wall Tiling. 532. Float the walls $\frac{3}{4}$ in. thick to receive tiles.

Keene's Cement.

Dado. 533. Run all around hall and vestibule a dado 4 ft. high in all, with skirting 12 in. high and moulded 4 in. girth, with the necessary dubbing, and flush moulding 6 in. girth as capping.

Angles. 534. Finish all the salient angles of the plastering, horizontal as well as vertical, with slightly chamfered arris and two 2 in. returns.

Archways and Recesses. 535. Execute in Keene's cement the reveals and the soffits of all archways and recesses, and mould the angles 6 in. girth with a 2 in. return and moulded stops, in vestibule, hall, and principal corridor on ground floor, as far as swing door, also in cloak room, library, dining-room, drawing-room, and billiard room, principal staircase, bedrooms 1, 2, 3, 4, 5, and dressing-room and corridor, as far as swing door, all on first floor.

The remainder of the archways and recesses to be similarly treated, but a chamfer 3 in. wide, with a 2 in. return, to be substituted for the moulding.

Portland Cement (Externally).

Gauging. 536. The Portland cement shall be mixed in the proportion of 1 of cement to 3 of sand.

Mouldings. 537. The whole of the mouldings to be worked to detail.

Rough Cast. 538. Render and float the brickwork between the half timbers finished rough cast with clean fine gravel stones well washed. When on quarters it shall be lathed with double fir laths.

Reveals of Windows in Tile Hanging. 539. Render and float in Portland cement the reveals and soffits of the windows in the tile-hanging, the soffits,

where wooden external lintels occur, to be lathed and counter-lathed in lath and half.

Soffits of Projecting Stories. 540. Lath, render, and float in Portland cement to soffits of projecting stories.

Remainder of Cement Work. 541. The whole of the work coloured grey on the elevations to be done in Portland cement. The plain face to be 1 in. thick and jointed as stone. The part where rustic grooves are shown to be $1\frac{1}{2}$ in. thick. Dub out for the rustic quoins with tiles and cement. The projections for cornices, string courses, and plinths shall be formed as far as possible in brick, and 3 in. self-faced York. Where this is impracticable dub out with tiles and cement.

Weathering. 542. Neatly weather the whole of the string courses and cornices in Portland cement.

Ornamental Panels. 543. The ornamental panels in relief in the eastern gable to be cast to design.

The panels in the northern gable to be incised to detail.

Cement Wash. 544. Colour the whole of the Portland cement work with a cement wash.

Tile Paving. 545. Lay the floor of porch with Minton's best 6 in. by 2 in. red encaustic tile paving, laid herring-bone in cement. Finish the edges with a border of similar tiles, two lines of black with one course of red between them.

Lay the floor of hall and corridor as far as swing door with encaustic tiles in three colours, P. C. 12*s*. per yard, and lay in Portland cement.

Mosaic. 546. Lay the floor of cloak room and lavatory with Rust's glass mosaic. P. C., including laying, 10*s*. 6*d*. per yard.

GLAZIER.—*See Notes, p.* 528.

Quality. 547. The whole of the glass to be English, of the best quality of its kind, clear of all bubbles, scratches, and other imperfections, to be well puttied and back puttied, and sprigged where required.

Wash Leather. 548. The glazing of all door panels to be bedded in wash leather or indiarubber.

Black Edges. 549. The edges of all plate glass to be blacked.

Clips. 550. At the bottom of each square of glass in skylights put two stout copper clips, screwed with brass screws.

Templates. 551. Supply all necessary templates.

21 oz. Sheet. 552. Glaze the whole of the windows not otherwise described with 21 oz. seconds sheet, that to the w.c.'s to be ground one side.

32 oz. Sheet. 553. Glaze with 32 oz. seconds sheet the borrowed light on third floor, and the windows of bedrooms 5, 7, and 10.

Fluted Rolled Plate. 554. Glaze with ⅛ in. small pattern fluted rolled plate the windows of basement throughout.

Glaze with ¼ in. small pattern fluted rolled plate the skylight of main roof.

Rough Plate. 555. Glaze with ½ in. rough plate let into a groove in the brickwork and pointed on both sides with cement the small light in the west wall of the woodhouse.

British Polished Plate. 556. Glaze with British polished plate of the best glazing quality the windows of dining-room, drawing-room, morning room, and billiard room, and the lantern of billiard room, also the upper panels of the swing doors on ground and first floor, bevel and polish 1 in. wide on both sides the margin of each square of glass in these doors.

Brilliant Cut Glass. 557. Glaze the door between porch and vestibule with British polished plate glass, brilliant cut, to design, P. C., including the glass, 10*s*. per foot superficial, and glaze it. Bevel and polish these squares 1 in. wide on both sides.

Iron Casements. 558. Fit the lights below transom of window in butler's pantry with Burt & Pott's (York Street, Westminster) section No. 10, quality No. 1 iron casements, bedded to the frame in white lead, and screwed with stout copper screws.

Cooper's Ventilators. 559. Fix in two of the fixed upper lights of billiard room windows a Cooper's ventilator, 10 in. diameter, to match the glass.

Lead Lights. 560. Glaze with stoutest lead lights of geometrical pattern to design and muffled glass in various tints with narrow border of clear glass, fixed with stout copper wire bands to ½ in. diameter wrought-iron saddle bars 16 in. apart, and all bedded in white lead, the windows of cloak room, w.c., and lavatory adjoining, and the windows of porch and hall.

Leave perfect. 561. Leave all glass clean and perfect at completion.

PAINTER.—*See Notes, p.* 533.

Materials. 562. The whole of the materials to be of the best quality, and to be submitted to such tests as the architect may

direct at the expense of the contractor. The oil colours to be made with the best old white lead and pure linseed oil, and to be mixed on the premises.

The varnish to be Manders's best polishing copal.

The size shall be fresh and sweet.

Tints. 563. The whole of the tints of the painting to be submitted to and approved by the architect.

Rub down. 564. The whole of the work to be well rubbed down and faced up after each coat of colour.

Different Tints. 565. The paint shall be of a different tint for each coat, and the whole of one coat finished throughout the building before another is put on; and no coat of paint shall be covered by another until it has been seen and passed by the architect or the clerk of works.

Deferring Painting. 566. Any part of the painting shall at the architect's option be deferred to any period within six months after the completion of the rest of the work without extra charge.

On Iron. 567. Paint the whole of the concealed ironwork two coats before fixing in Calley's Torbay paint.

Paint the whole of the exposed ironwork two coats before fixing in Calley's Torbay paint, and two coats after fixing of oil colour as described.

The eaves-gutters and rain-water pipes shall be painted inside and out.

Bars dipped. 568. Wrought-iron bars, straps, and bolts to have the scales scraped off to the bare metal, and, while hot, oiled with boiled linseed oil, dipped in the oil where possible; finish with coats of paint before mentioned.

Black Stoves. 569. Black the stoves and ranges.

On Internal Woodwork. 570. Knot, prime, stop, and paint, three oils, the whole of the woodwork usually painted, unless otherwise described, that to all the rooms and corridors east of the swing doors to be finished in parti-colours.

Flat. 571. The woodwork in morning-room to have, in addition to the coats before mentioned, one coat, flat.

External Woodwork. 572. Knot, prime, stop, and paint, five oils, the whole of the external woodwork usually painted, but excluding the oak work.

Pitch Pine Work. 573. Twice size and twice varnish the joinery described to be in pitch pine.

Varnish. 574. Varnish the painted woodwork of kitchen, scullery, and servants' passagé.

Internal Oak Work. 575. Dull French polish in the best manner the whole of the internal oak woodwork, including the floors, except floor of ball-room, which shall be thoroughly wax-polished.

French polish. 576. French polish in the best manner the whole of the teak and mahogany work. This shall all be effectually protected, the handrails to be covered with canvas or stout brown paper.

External Oak Work. 577. Twice oil the external oak work, and well rub after each oiling.

Writing. 578. Paint a number in 1 in. numerals under each bell.

Gilding. 579. Gild with double gold English leaf, burnished and sized, the whole of the exposed part of the iron finial on the turret roof.

Distempering. 580. Clearcolle and distemper to an approved tint the walls of butler's pantry and garden entrance lobby.

Touch up. 581. Touch up the painted work at completion, and leave all perfect.

PAPERHANGER.—*See Notes, p.* 536.

Prepare Walls. 582. Rub down, size, stop, and prepare all walls to receive paper.

Varnish. 583. The varnish generally to be the best French oil varnish.

Butt Joints and Prices. 584. The whole of the paper to be carefully hung with butt joints. The prices to be net after deducting the trade discount.

Defects. 585. If any paper after hanging shows creases, lumps, smears, or damage of any kind, such part shall be removed and repapered at contractor's expense; if it cannot be reinstated satisfactorily the whole of the apartment shall be stripped and repapered at the contractor's expense.

Lining Paper. 586. The lining paper to be best stout elephant lining paper, rubbed down and sized.

Third Floor. 587. Hang with paper, at 1*s*. per piece, the walls of all rooms and passages on third floor, except those described to be distempered.

Second Foor. 588. Hang with paper, at 1*s*. per piece, all the rooms on second floor, except those hereafter described.

Paper the servants' bath room with a sanitary paper at 1*s*. 6*d*. per piece, twice size and twice varnish.

Paper the best bath room and boudoir w.c. with a sanitary paper at 2*s*. 6*d*. per piece, twice size and twice varnish with the best mastic varnish.

Paper bedrooms 9 and 10 with lining paper as described, and wall paper at 5*s*. per piece.

Paper the boudoir with lining paper as described, and wall paper at 6*s*. per piece, with a frieze at 3*s*. per yard.

First Floor. Describe in detail as for the upper floors.

Ground Floor—Drawing-room. 589. Paper the drawing-room with lining paper as described, and wall paper at 5*s*. per piece.

Dining-room. 589A. Paper the dining-room with lining paper and wall paper at 5*s*. per piece, the ceiling with paper at 3*s*. per piece.

Billiard Room. 590. Paper the billiard room with lining paper, and filling above dado with paper at 5*s*. per piece, frieze at 3*s*. per yard. Dado, 3 ft. 6 in. high, of Lincrusta-Walton at 3*s*. 6*d*. per yard run, painted two coats and once varnished.

Library. 591. Paper the library with lining paper, and wall paper at 3*s*. per piece, frieze at 2*s*. per yard run.

W.C.'s. 592. Paper the best w.c. and cloak room with sanitary paper at 2*s*. 6*d*. per piece, twice size and twice varnish.

Paper the housekeeper's w.c. with sanitary paper at 1*s*. 6*d*. per piece, twice size and twice varnish.

House-keeper's Room. 593. Paper the housekeeper's room and servants' hall with paper at 2*s*. per piece.

Passages. 594. The passages east of swing door with paper at 2*s*. per piece, twice sized and twice varnished.

Vestibule, Hall, and Stairs. 595. Paper the vestibule, hall, as far as swing door, principal staircase, and landing and corridor, as far as swing door, first floor, with lining paper, and filling at 5*s*. per piece, with dado (3 ft. 6 in. high) of Lincrusta-Walton at 3*s*. 6*d*. per yard run, painted two coats and once varnished.

Principal Staircase from First to Third Floor. 596. Paper with lining paper and paper at 3*s*. 6*d*. per piece.

Servants' Staircase from Ground to Third Floor. 597. Paper with paper at 2*s*. per piece, twice size and twice varnish.

VENTILATION.—*See Notes, p. 538.*

Boyle's Ventilators. 598. Fix where directed in dining hall three Boyle's bracket air inlets, with adjusting valve but no air strainer. Form openings through walls, rendered in cement, and fix on outer face of wall 9 in. by 6 in. cast-iron ornamental air grating. One similar inlet in each of the masters' sitting-rooms.

Gratings. 599. Supply and fix as inlets to ventilating tubes No. 18 9 in. by 6 in. cast-iron ornamental gratings, and form and render the openings through walls with cement.

Tobin's Tubes. 600. Supply and fix No. 18 Tobin's tubes, to be made of 1 in. deal wrought both sides 9 in. by 6 in. in clear and 6 ft. high, the external angles rebated and staff-beaded.

Finish at top of each with $1\frac{1}{4}$ in. deal mitre-clamped flap, hung with 2 in. brass butts to stile, and the exposed edges rounded.

Fix in the mouth of each tube a piece of galvanized iron wire netting. The walls will form the backs of the tubes, which are to be accurately scribed and fitted thereto.

LIGHTNING CONDUCTOR IN ALL TRADES.

Maker to be approved. 601. Supply a lightning conductor, which shall be made and fixed by an approved firm.

Testing. 602. The contractor shall test the conductor and its earth connection with a battery and galvanometer, and the indicated resistance shall be to the satisfaction of the architect.

Conductivity. 603. The copper in wire rope points and earth plate shall be equal to 95 per cent. of the conductivity of pure copper.

Joints in Rope. 604. Joints or splices in the rope shall be as far as possible avoided, but if unavoidable they shall be spliced and soldered in the best known manner, and the conductivity in the joint shall be at least 5 per cent. more than in the rope.

Earth Plate. 605. Dig near the north-eastern angle of the building a hole 5 ft. by 5 ft., and 6 ft. deep. Supply an earth plate of copper, $\frac{1}{16}$ in. thick, securely attached to the rope. Fill the hole with small broken coke.

Rope and Points. 606. From the earth plate carry up the north-eastern angle of the building, to the top of the chimney shaft, a $\frac{5}{8}$ in. diameter copper rope. and terminate it with $\frac{5}{8}$ in. diameter polished copper rod, 4 ft. long, with five points. From the north-eastern angle of the building, immediately below the eaves cornice, continue the copper rope southward around the south-eastern angle and along the southern wall of the building as far as the kitchen chimney shaft, and up that shaft to the top. Finish with a copper rod as before described.

Clips and Coupling Sockets. 607. Fix the rope to the brickwork with stout copper clips and copper nails, and connect the rope with the terminals by copper coupling sockets screwed on.

Protect Rope at Foot. 608. Protect the rope, for a height of 5 ft. from the ground, by $1\frac{1}{4}$ in. galvanized iron tube, secured to the wall. This part of the rope to be insulated in an approved manner.

CONSERVATORY.

Generally. 609. All descriptions of materials and labour shall be as described for the main building. (See General Specification.)

Provisions. 610. Provide for heating apparatus and fixing, £27 10*s*.

Provide for carriage of heating apparatus and attendances in all trades on the engineer, £5.

Provide for iron finial and fixing, £3.

Concrete. 611. Lay cement concrete 6 in. thick beneath the pavings.

Lay lime concrete 9 in. deep and 30 in. wide under the external step.

Gulleys. 612. Put at foot of rain-water pipe a Doulton's No. 16 yard gulley.

Channel for Pipes. 613. Build a channel for the hot-water pipes between heating chamber and conservatory 9 in. by 12 in. clear, of half brick sides and brick flat bottom, all in cement, with 2 in. rough York cover.

Flue for Heating Apparatus. 614. Connect the heating chamber by a brick flue with a special flue arranged to receive it in the library chimney stack.

Paving. 615. Pave the conservatory with tile paving. P. C. 7*s*. 6*d*. per yard.

Pave the heating chamber with Portland cement paving, 1 in. thick, floated and finished in pure cement.

Oversailing. 616. Oversail to receive slate shelves.

Facings. 617. Face the inside and outside of conservatory with facings and pointing as described for the house.

Templates. 618. Put 3 in. by 9 in. by 9 in. tooled York templates, rubbed where exposed, to ends of purlins.

Steps. 619. The upper step to conservatory entrance to be 14 in. by 6 in. York rubbed; the two lower steps to be similar, but 12 in. by 6 in.

Roof Tiling. 620. Cover the roof of the heating chamber with tiling as described for the house. Point the verges with cement. Put lime and hair filleting instead of flashing.

Slate Shelves. 621. Supply in conservatory one tier of $1\frac{1}{4}$ in. rubbed one side slate shelves, with rubbed edges and quadrant corners, supported by ornamental wrought-iron brackets, 20 in. by 15 in., screwed with stout screws to wooden plugs in the wall and to lead plugs in the shelf.

Roof of Heating Chamber. 622. Construct the roof of the heating chamber of upper plate $4\frac{1}{2}$ in. by 3 in., lower plate 5 in. by 4 in., wrought. Rafters, $4\frac{1}{2}$ in. by $2\frac{1}{2}$ in. No boarding. Eaves fillet as to main roof.

Woodwork. 623. The whole of the woodwork of the conservatory to be put together in white lead.

Chamfer, &c., Edges of Casements. 624. The casements to be narrow chamfered all round, to form V-joint with the mullions.

The lower edges to be splay-rebated and grooved.

Wall Plate. 625. Where the conservatory roof adjoins the north wall of house fix 4 in. by 4 in. wrought plate.

Enclosure. 626. Construct the enclosure of the conservatory with oak sill, 6 in. by 3 in., double-sunk weathered, throated and check-throated, the angles to be framed and secured with 6 in. joint screws. The head to be fir, 4 in. by 4 in., ovolo moulded and narrow chamfered, and with angles as last. The transom to be 4 in. by 3 in., double-sunk weathered, check-throated, ovolo moulded and twice narrow chamfered. The mullions next walls to be 4 in. by 3 in., ovolo moulded and narrow chamfered. Angle mullions, 4 in. by 4 in., thrice ovolo moulded and narrow chamfered. The mullions where principals occur to be 4 in. by 4 in., twice ovolo moulded and twice narrow

chamfered. The other mullions to be 4 in. by 3 in., and as last. The posts of doorway to be 4 in. by 3 in., rebated, twice ovolo moulded and twice narrow chamfered. The casements to be 2 in., moulded in single squares, fitted inside with $\frac{3}{4}$ in. by 1 in. twice chamfered fillets as beads, screwed with small brass screws and cups. The casements marked thus X on the drawing are to open, those below transom to be hung with 3 in. brass butts, and fitted with 9 in. japanned iron slotted stays, and strong japanned iron Cockspur fastenings; those above transom to be hung on 3 in. brass centres, with steel bushes, the beads to be cut. Fit with Elsley's (Great Marlborough Street, London) gear, part gun-metal.

Principals. 627. The principals of the roof to be of two thicknesses of 1 in. deal, wrought and screwed together, the heads of the screws to be countersunk, the backs of the ribs to be housed and the exposed edges twice ovolo moulded.

Screw each of the ribs to the mullions with six 6 in. stout screws, the heads let in and pelleted.

Purlins. 628. Construct the roof of purlins 8 in. by 5 in., twice ovolo moulded. Plate next wall of house 4 in. by 4 in. Ridge, 9 in. by 2 in., twice ovolo moulded.

Skylights. 629. The skylight to be $2\frac{1}{4}$ in. moulded, with moulded bars 2 in. wide, and moulded as Fig. 24, and with stiles where the ribs occur, all about 12 in. apart, screwed with brass screws and throated on exposed edges. Finish the ridge with 2 in. birdsmouthed roll. Fix at the end of the ridge a deal turned base out of 7 in. by 7 in. by 8 in., to receive the iron finial.

FIG. 24.

Lantern. 630. Construct the lantern of 6 in. by 3 in. oak sill angle posts, head, mullions and casements and skylight as described for the lower part, 2 in. ribs as described for the principals. The casements to be hung on centres as before, and all to open with Elsley's gear as before, one set to each side of the lantern.

Fix to the head of the lantern, on the inside, $2\frac{1}{2}$ in. by $3\frac{1}{2}$ in. moulding, returned up the sides of the ribs and along each side of the ridge.

At the junction of the lower skylights with the curb of

lantern put 2 in. by 2 in. moulding, splayed on the upper edge.

Fix inside the sill of the lantern $2\frac{1}{2}$ in. by 2 in. zinc condensation gutter, screwed with stout screws, with lengths of $\frac{3}{4}$ in. pipe carried through the curb as outlets.

Eaves Cornice. 631. Finish below the eaves-gutter, on the outside of enclosure, $1\frac{1}{2}$ in. by $2\frac{1}{2}$ in. deal moulding, carried along the end transom and up the rake of gable.

Door. 632. The door to be 3 ft. by 7 ft. 2 in. three panel, moulded both sides, the lower panels moulded on solid, the upper panel with diminished stiles, rebated and prepared for glass, and with mouldings fixed with brass screws and cups. Hang with $3\frac{1}{2}$ in. butts. Fit with 7 in. mortise lock and brass furniture.

Flush mould the lock rail 9 in. girth inside and out. Put over the door head $2\frac{1}{2}$ in. by 3 in. moulding as cornice, the back edge rebated and let in, and the moulding returned and mitred.

Eaves-gutter. 633. Fix to eaves 4 in. by 3 in. Macfarlane's (Glasgow) cast-iron moulded eaves-gutter.

Rain-water Pipe. 634. Put $2\frac{1}{2}$ in. cast-iron round rain-water pipe.

Lead. 635. Put to lantern an apron of 5 lbs. lead, 12 in. wide.

Where the lantern and skylights adjoin the western wall of the house, put stepped flashing, 12 in. wide, of 5 lbs. lead.

The exposed edges of the lead to be closely copper nailed and bedded in white lead.

Glazing. 636. Glaze the casements with 21 oz. sheet.

Glaze the skylight with $\frac{1}{8}$ in. small pattern fluted rolled plate, in single squares, each secured at bottom with two stout copper clips, screwed with brass screws.

Glaze the panel of door with British polished plate.

STABLES.

Generally. 637. All descriptions of material and labour shall be as described for the main building. (See General Specification.)

Provisions. 638. Provide for vane and fixing £6.

Provide for harness-room stove £2 10*s*.

Digging. 639. Dig the general surface to a depth of 6 in. all over the site, and deposit where directed by the gardeners.

Concrete. 640. The concrete in trenches to be 9 in. thick.

Concrete under Pavings. 641. Lay beneath all pavings, except the granolithic, cement concrete 6 in. thick.

Gravel to receive Paving. 642. Lay beneath the granolithic paving in yard clean gravel 6 in. thick, rammed and levelled to falls.

Drains. 643. Supply to receive rain-water five Doulton's (Fig. 15) gulleys, with dished cover and galvanized iron grating.

Supply in the middle of the stable yard a brick cesspool 9 in. by 9 in. and 18 in. deep, all in clear built and rendered in cement, bedded on 6 in. of cement concrete, which will form the bottom, and Waller's (Park Street, Southwark), No. 72 gulley grate, with hinged grating bedded on the brickwork.

Drain Pot and Gutters. 644. Supply in loose box and in channel at heel posts a St. Pancras Ironworks Company's (St. Pancras Road, London) No. 690 trapped drain pot, bedded in cement concrete and connected with the drains. Supply for a length equal to the total width of the stalls and in the loose box four arms, each 3 ft. long, of No. 341 wrought gutter, all bedded in cement concrete.

Walls. 645. The brick walls shall be built solid.

Work in Cement. 646. Build in cement the chimney shaft from the surface of the roof to the top.

Chimney Pot. 647. The fireplace in harness-room to have a terra-cotta chimney pot, P. C. 3*s*. 6*d*., set and flaunched with cement.

Set Stove. 648. Set the harness-room stove.

Ventilators. 649. Form openings, one over each manger and one in loose box, with three York lintel 9 in. longer than opening, and rubbed in soffit and edges, and supply St. Pancras No. 258 improved quadrant movable ventilators, glazed with 21 oz. sheet, with hook for cord, self-acting fastener, and iron grating.

Limewhite. 650. Strike the joints fair, and twice limewhite the walls of loft.

Damp-proof Course. 650A. The damp-proof course to be of pitch, tar, and sand.

Paving. 651. Pave the stable and loose box with best blue Staffordshire grooved paving bricks 9 in. by $4\frac{1}{2}$ in. by 3 in. thoroughly vitrified through their whole substance, set and grouted with cement.

Pave the stable yard with granolithic paving 2 in. thick, by an approved maker laid to falls and grooved.

Air Bricks. 652. Supply to ventilate harness-room floor four 9 in. by 3 in. cast-iron air bricks, and render the openings through the walls with cement.

Facings. 653. Face the walls and chimney shaft with approved bright picked stocks of uniform colour, laid Flemish bond, finished with a neatly-struck bevelled joint as the work proceeds. The perpends to be carefully kept.

Arches. 654. The arches to be of similar bricks, segmental in two half-brick rings, set in cement, and raked out and pointed to match the facings.

Plinth. 655. The plinth to be of red splayed bricks on edge, all headers, and set in cement. The footings shall not be increased in width because of the plinth.

Window Sills. 656. The window sills to be of two courses of red splayed bricks, all headers, in cement.

Coping. 657. Cope the wall of stable yard with Brown's (Braintree) No. — red coping bricks set in cement, the angles to be purpose made and solid.

Chimney Shaft. 658. Finish the chimney shaft with oversailing courses, and one course of red splayed bricks as capping.

Gable and Eaves Cornices. 659. Oversail at eaves and up-rakes of gable, with the lowest course set dog's-tooth to form gable and eaves cornices.

Brick Panel. 660. Supply a red brick ornamental panel with date, P. C. £1, to be selected, and fix it in the eastern gable.

Templates. 661. Supply 3 in. by 9 in. by 9 in. tooled York templates to ends of tie beams and ridges.

Put similar templates, but rubbed where exposed, to ends of lintel over coach-house.

Hearth. 662. Put to harness-room fireplace 3 in. rubbed York hearth and back hearth, and 7 in. by $1\frac{1}{2}$ in. rubbed York jambs, mantel, and shelf.

Thresholds. 663. Put 9 in. by 4 in. York tooled thresholds to all doorways except coach-house.

Put to coach-house 15 in. by 4 in. York tooled threshold continued beyond each jamb of doorway as far as the cross walls, to be grooved $\frac{1}{2}$ in. deep for running rail, which shall be run with lead.

Coping. 664. Cope the dwarf wall of manure pit with 14 in. by

3 in. tooled York coping, throated both edges, and bedded and jointed in cement, and in lengths of not less than 4 ft.

Tiling. 665. Cover the roof with best Broseley tiles of true shape and uniform colour, and free from fire cracks and other defects, laid to a $3\frac{1}{2}$ in. gauge, with two $1\frac{1}{4}$ in. galvanized steel nails to each tile to $1\frac{1}{4}$ in. by 1 in. sawn for laths, all cut close to eaves, ridges, and vertical faces, and the eaves laid double.

Valley Tiles. 666. The hip and valley tiles to be purpose made to course, and bond with the general tiling.

Ridge. 667. Finish the ridge with Broseley ridge tiles with plain roll, all of colour to match the general tiling, and set and point with cement.

Weather Tiling. 668. Put weather tiling to similar gauge, and nailed with similar nails, to $1\frac{1}{4}$ in. by 1 in. battens plugged to the brickwork.

Verges. 669. Finish the verges with a double course of tiles and tile soffit and hollow fillet, all in cement.

Flèche. 670. Cover the flèche with tiling as described, but screwed with copper screws.

Hips of Flèche. 671. The hips of flèche to be closely cut and mitred, and bedded in cement.

Lintel of Coach-house Gateway. 672. The lintel of coach-house to be made of four 9 in. by 3 in. deals bolted with $\frac{1}{2}$ in. bolts 2 ft. apart, wrought in soffit and 2 faces, V-jointed at the joint between the deals, ovolo moulded 3 in. girth on the lower angles with moulded stops.

Roof. 673. Construct the roof of three tie beams 9 in. by 3 in. laid in the thickness of the floor, and bolted with $\frac{1}{2}$ in. bolts 3 ft. apart to the joists adjoining. Ridge $1\frac{1}{2}$ in. by 9 in., rafters $4\frac{1}{2}$ in. by $2\frac{1}{4}$ in., purlins 8 in. by 5 in., struts from tie beams to purlins 4 in. by 4 in., the alternate pairs of rafters to have $4\frac{1}{2}$ in. by $2\frac{1}{4}$ in. collars, 1 in. by 7 in. eaves board and 3 in. by 2 in. splayed eaves fillet. No boarding or felt.

Flèche. 674. Construct the flèche (Fig. 25) of 6 in. by 4 in. curb, extending from tie beam to tie beam, and cross pieces bolted with $\frac{3}{4}$ in. bolts. Carry up from these 5 in. by 4 in. angle posts framed at the apex of the spire into a 4 in. by 4 in. centre post. Construct the lower part of the flèche of heads and sills 4 in. by 3 in., quarters 4 in.

Flèche. by 2½ in. Above head and below sill of louvred part put plates 4 in. by 3 in. with 4 in. by 3 in. horizontal crossing pieces framed into them, two to each plate. The rafters of spire to be 4 in. by 2¼ in. covered with 1 in. rough boarding. Put to the foot of each rafter a deal shaped sprocket. Finish the base of spire with moulding out of 4 in. by 3 in. and base of louvred part with moulding out of 5 in. by 4 in. The angles of these mouldings shall be tongued, mitred, and screwed.

Fill in the open part with mullions 4 in. by 3 in. and thirty-two 1 in. by 7 in. wrought louvres. The angle posts to be wrought and finished with a 2½ in. deal birds-mouthed roll, stopping against the upper and lower mouldings. Plant similar roll on the face of each mullion.

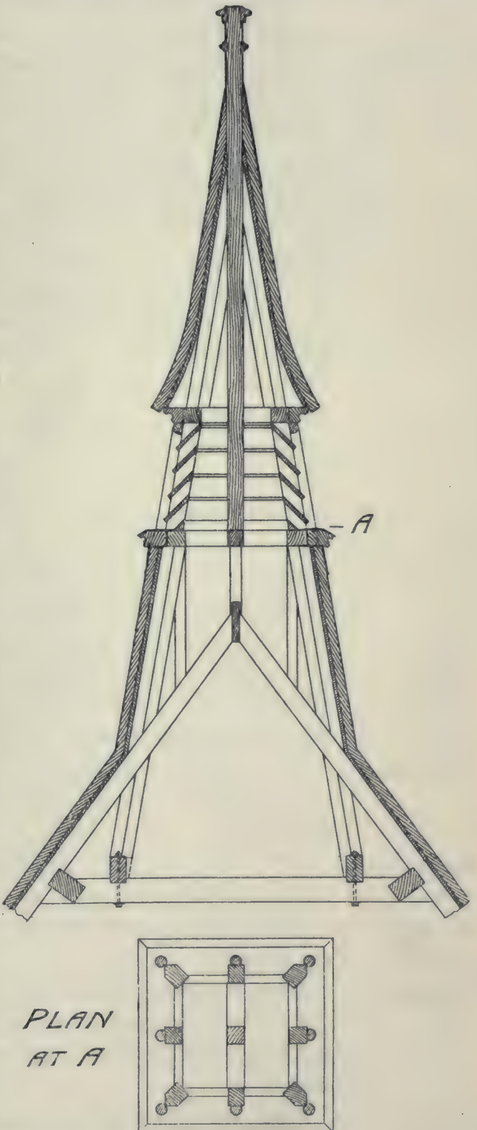

FIG. 25.

At base of spire line with $\frac{3}{4}$ in. matched and beaded boarding. At base of louvred part lay 1 in. rough boarding on $3\frac{1}{2}$ in. by 2 in. bearers to receive lead as flat.

Dormer. 675. Construct the dormer with footing pieces as valleys 5 in. by $2\frac{1}{4}$ in. Plate at eaves 4 in. by 4 in. wrought, and the exposed ends moulded. Put under each projecting end of plate a wrought deal bracket 4 in. by 14 in. by 24 in., housed at top and back edge, shaped in front, and twice ovolo moulded $1\frac{1}{4}$ in. girth. Ridge $1\frac{1}{4}$ in. by 7 in. Rafters $4\frac{1}{2}$ in. by $2\frac{1}{4}$ in., the front pair wrought as barge board. The exposed ends of the other rafters to be wrought and shaped. Construct the cheeks of 1 in. boarding and fir framed quarters. Put to verge 1 in. wrought one side and V-jointed boarding in $4\frac{1}{2}$ in. widths as soffit. Plant on the barge rafters 2 in. by 2 in. deal moulding scribed to the soffit of tile verge and the ends moulded. Construct the front of $4\frac{1}{2}$ in. by 4 in. rebated and moulded frame with 2 in. by 12 in. oak sill with rounded nosing, the sill to project and to be supported by four 4 in. by 9 in. by 6 in. oak brackets, shaped and twice chamfered, housed into sill, &c., plugged to the brickwork. The door to be 3 ft. by 7 ft. 2 in. deal, framed and braced, and filled in with 1 in. V-jointed one side grooved and tongued boarding in 4 in. widths, hung with $3\frac{1}{2}$ in. iron butts. Fit with strong japanned iron Norfolk thumb latch and 6 in. Tower bolt.

Loft Floor. 676. Construct the floor of the loft with $4\frac{1}{2}$ in. by 3 in. plates, $2\frac{1}{4}$ in. by 9 in. joists, and one row of herring-bone strutting.

Loft Flooring. 677. Lay the floor of loft with $1\frac{1}{4}$ in. yellow deal battens laid straight, joint with splayed headings.

Skirting. 678. Put all around the loft 2 in. by 2 in. splayed fillet as skirting.

Windows. 679. Fit the window openings of stable with 6 in. by 3 in. oak sill double sunk weathered and check-throated, $4\frac{1}{2}$ in. by 3 in. deal frame twice ovolo moulded, grooved for lead lights.

Harness-Room Door. 680. The door of harness-room to be 3 ft. by 7 ft. 9 in., 2 in. two panel square framed, the lower panel filled in with 1 in. boarding as before, the upper panel with large moulded bars and rebated and prepared for glass, hung with $3\frac{1}{2}$ in. iron butts to $4\frac{1}{2}$ in. by 3 in. fir frame as last. Fit with 7 in.

mortise lock and strong brass furniture. Finish with 1 in. staff beaded linings.

Gates. 681. The coach-house gates to be 8 ft. 6 in. by 8 ft. 6 in. in two leaves $2\frac{1}{4}$ in., framed and braced, filled in with $1\frac{1}{4}$ in. V-jointed one side grooved and tongued boarding in 4 in. widths. Rebate and bead the meeting stiles. Fit to the bottom of doors four Hatfield's (Kenrick and Sons, West Bromwich) 4 in. bottom rollers to roll on $\frac{1}{2}$ in. by 3 in. wrought-iron rail with rib as runner, and perforated to form sockets for flush bolts. Supply as handles four $3\frac{1}{2}$ in. brass sunk sash lifts. Fix at top of doors eight $1\frac{1}{2}$ in. brass friction rollers. Fix to the soffit of lintel as guide 2 in. by 2 in. angle iron screwed with stout screws 9 in. apart, the heads countersunk.

Also fit the pair of doors with Hobbs' sliding door back-action clutch lock and one $1\frac{1}{2}$ in. by 12 in. and one $1\frac{1}{2}$ in. by 18 in. brass flush bolt.

Stable Door. 682. The stable door to be 4 ft. by 7 ft. 9 in., 2 in. framed and braced, filled in with 1 in. V-jointed one side grooved and tongued boarding in 4 in. widths, hung in two heights with $3\frac{1}{2}$ in. iron butts to $4\frac{1}{2}$ in. by 4 in. rebated and moulded frame. Fit with 6 in. tower bolt and 6 in. upright mortise dead lock and stable latch, with strong brass bronzed flushed furniture. Where the bottom rail of the upper and the top rail of the lower part meet, splay the edges and fix with strong screws with countersunk heads 2 in. by $\frac{1}{8}$ in. galvanized wrought-iron bar, the rails rebated to receive it as Fig. 26.

Fig. 26.

Stable Fittings. 683. The iron stable fittings shall be supplied by the St. Pancras Ironworks Co., St. Pancras Road, London, and the numbers are from their catalogue. Line the walls of stable for a height of 4 ft. 6 in. with 1 in. wrought and V-jointed grooved and tongued boarding in 4 in. widths, fixed to 1 in. by 3 in. horizontal grounds plugged to wall, fitted to iron capping and sill to match those of stall divisions; both shall have solid angles. Tongue the internal angles of the boarding, and tongue and staff bead the external angles.

Finish around ceiling of stable with 4 in. by 3 in. moulding as cornice.

Supply stall divisions No. 16 with $3\frac{1}{2}$ in. cast-iron post

Stable Fittings. with self-fixing base, ramp, and sill, and fill in with 2 in. boarding to match that on walls, but tongued with $1\frac{1}{4}$ in. painted hoop iron and V-jointed both sides.

Supply half-ramp sill and post to match the stall division. Fill in with boarding as last, but V-jointed one side only.

The sills to have shifting pieces for the removal of the boarding.

Embed the base of each post in a block of cement concrete 2 ft. by 2 ft. by 2 ft.

Enclose the loose box with $3\frac{1}{2}$ in. cast-iron posts with self-fixing bases as before, with half-posts next the walls, and No. 218 wrought-iron ventilating grating with cast-iron top capping sill and intermediate sill, fill in with 2 in. boarding as described for the stall divisions.

Supply a set of No. 220 iron and brass work for door 3 ft. 8 in. wide, comprising ventilating grating 2 ft. deep, improved hangings, and No. 148 patent safety brass latch. Construct 2 in. door with diminished stiles to match the boarding of enclosure.

Fit each stall with No. 419 patent enamelled manger fitting. The loose box with No. 77 patent manger fitting.

Wall Linings. 684. Line the walls and ceiling of harness-room with $\frac{3}{4}$ in. V-jointed, tongued and grooved boarding in 4 in. widths; tongued at internal angles, and rebated, grooved and staff beaded at external angles. Finish around ceiling with a 3 in. by 2 in. moulding as cornice, and around floor with $\frac{3}{4}$ in. by 7 in. Torus skirting.

Harness-Room Fittings. 685. Supply a bit case, P. C. 50*s*., a No. 117 japanned harness cleaning bracket; three No. 116 driving whip holders; four No. 33 japanned harness brackets, 14 in. projection; two No. 171 japanned 16 in. projection saddle brackets; three No. 30 japanned rein hooks.

Hay Shoot. 686. Fit the front of hay shoot with $1\frac{1}{2}$ in. chamfered framing, the panels filled in flush with 1 in. boarding to match the wall linings. Form therein an opening, chamfered all around, with a framed and chamfered shutter 2 ft. 6 in. by 5 ft., in two panels to match the front, hung with best flax lines, brass axle pulleys, and iron weights in deal cased frame of $1\frac{1}{4}$ in. pulley stiles, 1 in. inside and outside linings, and chamfered fillets as beads, screwed with

brass screws and cups. Fit the shutter with two 3 in. brass sunk sash lifts.

Wall Ladder. 687. Supply and fix in hay shoot, to plugs in wall, a wall ladder, 15 ft. long and 15 in. wide, of $3\frac{1}{2}$ in. by 2 in. sides and 2 in. by 2 in. rounds, about 9 in. apart, all halved together and screwed.

Corn Bin and Shoot. 688. Supply in the loft a corn bin 4 ft. by 4 ft. by 3 ft. 6 in., all in clear, of $1\frac{1}{2}$ in. wrought and dovetailed sides and $1\frac{1}{4}$ in. bottom, fitted and blocked up to fall four ways towards corn shoot. Fit with $1\frac{1}{4}$ in. flush-framed lid, hung with 24 in. strong wrought-iron hinges. Supply padlock, P. C. 4*s*., and iron hasp and staple. Supply from bin to a level of 3 ft. 6 in. above the stable floor, No. 347 improved corn shoot, with meter and hopper head.

Line the bin with No. 12 zinc, soldered and nailed with zinc nails.

Eaves Gutter. 689. The eaves gutters to be cast iron, 4 in. ogee.

Rain-water Pipes. 690. The rain-water pipes 3 in. cast iron, with a shoe to each stack.

Gas Pipes. 691. Supply 50 ft. of $\frac{1}{2}$ in. gas tubing, 100 ft. of $\frac{3}{4}$ in., and fixing.

Gas Brackets. 692. Supply two gas brackets, P. C. 5*s*. each, with mahogany rose to each.

Plastered Ceilings. 693. Lath, plaster, float, and set the ceilings of stable and coach-house.

Plastered Walls. 694. Render, float, and set the walls of the stable above the dado.

Reveals of Windows. 695. Finish the reveals of stable windows in Keene's cement with slightly chamfered arris and 2 in. return.

Lead covering of Finial. 696. Cover the finials of flèche with 7 lbs. lead, corrugate the lower edge of this lead.

Soakers. 697. To the hips of flèche put soakers, 9 in. by 7 in., one to each course of the tiles.

At the junction of the ridge of the dormer with the slope of the main roof, put a soaker, 18 in. by 18 in., of 5 lbs. lead.

At the lower edge of the cheeks of loft dormer put soakers, 8 in. by 7 in., one to each course of tiles.

Water Supply 698. Lay on the water from the nearest house supply to the draw-off near stable door, with $\frac{3}{4}$ in. pipe and $\frac{3}{4}$ in. bib cock.

Glazing. 699. Glaze the upper panels of the harness-room door with 26 oz. sheet.

Lead Glazing. 700. Glaze the windows of the stable with 15 oz. sheet, in stoutest lead quarry lights, bedded in white lead, and fixed with stout copper wire bands to ½ in. diameter saddle bars, about 15 in. apart.

Distemper. 701. Clearcolle and distemper to a tint the work described to be plastered.

BOUNDARY WALLS.

Generally. 702. All descriptions of materials and labour shall be as described for the main building. (See General Specification.)

Concrete. 703. The whole of the concrete to be lime concrete. The concrete to gate piers to be 18 in. deep, boundary walls 12 in. deep. Build the boundary walls to detail. Lay beneath the threshold to the stable yard concrete 18 in. wide and 12 in. deep.

Work in Cement. 704. Build in cement the piers of gates, the copings, and the plinths.

Facing. 705. Face the walls of stable yard, next the road, with best red Hathern facing bricks, the side next yard with picked stocks, both raked out and pointed with a neatly struck weathered joint in cement.

Face the piers of stable gates and the piers of carriage entrance with Hathern bricks as before, with similar pointing.

Face the garden wall with picked stocks, finished with a neatly struck weathered joint as the work proceeds. Finish the tops of the piers with two courses of blue Staffordshire splayed bricks, all headers in cement. Finish the top of wall with brick on edge in cement.

Damp-proof Course. 706. No damp-proof course will be required for any of these walls.

Threshold to Gateway. 707. Put to the gateway of the stable yard 18 in. by 6 in. tooled York threshold in one length.

Spur Stones. 708. Supply for stable gateway two Aberdeen granite rounded spur stones 12 in. by 9 in. and 3 ft. 6 in. long, with rounded tops, to stand 18 in. above ground, and finely axed where exposed.

Thresholds to Small Doorways. 709. Put to the two small doorways of stable yard 3 in. by 9 in. tooled thresholds.

Pier Caps. 710. Finish the piers of the stable gates with 22 in. by 22 in. by 6 in. tooled York caps, weathered four ways, and throated all around.

Finish the piers of the smaller gates of the stable yard with similar caps, but 16 in. by 16 in. by 4 in.

Hinge Stones. 711. The stable gates to have rubbed York hinge stones, rebated for the gates and 18 in. by 18 in. by 12 in.

The smaller stable gates to have 14 in. by 14 in. by 9 in. similar hinge stones rebated for the gates, and 14 in. by 9 in. by 9 in. lock stone, also rebated. Put to the piers of gateways of carriage entrance, rubbed York hinge stones the whole size of the plan of piers and 9 in. high.

Caps to Piers of Carriage Entrance. 711A. The caps to be of Bath stone, the whole size of the plan of pier and 18 in. high to detail.

Larger Gates of Stable Yard. 712. The gates of the stable yard to be 7 ft. high, $2\frac{1}{2}$ in. framed and braced, filled in with $1\frac{1}{4}$ in. grooved, tongued and V-jointed both sides boarding in 4 in. widths, the ledges and braces to be chamfered, and the stiles stop-chamfered. Hang folding with two pairs of wrought-iron strap hinges 3 ft. 9 in. long, with back straps 24 in. long, and double fanged hooks let into the hinge stones and run with lead. Bolt each hinge with four $\frac{1}{2}$ in. bolts with hexagon heads and nuts. Finish the top of the gates with 4 in. by 3 in. capping, grooved on, twice weathered, and both edges moulded.

Fit with a strong wrought-iron gate latch, with bar handle, a 6 in. upright mortise dead lock, a $\frac{3}{4}$ in. diameter wrought-iron stay 5 ft. long, with eye and plate at one end, bolted to 4 in. by 4 in. oak wrought post, 4 ft. long, 18 in. out of ground and 24 in. in the ground, the other end with eye and plate screwed to the gate and fitted with padlock, P. C. 4*s*. Supply a self-acting cast-iron gate stop, P. C. 10*s*., and let into stone threshold and run with lead.

Smaller Gates of Stable Yard. 713. The other two gates to the stable yard to be 3 ft. 3 in. by 6 ft. 6 in., 2 in. framed and braced, filled in with 1 in. grooved, tongued and V-jointed both sides boarding in 4 in. widths. Finish at top with $3\frac{1}{2}$ in. by 2 in. capping grooved on and moulded both edges. Hang with wrought-iron strap hinges, 2 ft. 6 in. long, with back straps 18 in.

long, and double fanged hooks let into the hinge stones and run with lead. Each hinge bolted with four $\frac{1}{2}$ in. bolts with ornamental heads and nuts. Fit with 6 in. upright mortise lock, with strongest brass furniture, and iron staple let into the lock stone and run with lead.

Gates to Carriage Entrance.

714. The gates at carriage entrances to be 3 in. thick to detail, framed, and pinned with oak pins, and put together with white lead. The hinge stiles out of 12 in. by 3 in., lock stile out of $5\frac{1}{2}$ in. by 3 in. Rails 4 in. by 3 in. and 3 in. by 3 in., intermediate stiles $2\frac{1}{2}$ in. by 3 in. Braces 3 in. by 3 in., with rounded ends and stout oak draw pins. Mould the ends of the stiles and the upper edge of the top rail. Fill in between the two upper rails and the two lower rails with 1 in. deal, housed in all round and pierced to design. Chamfer all the edges of stiles and rails 1 in. wide.

Hang at top with one wrought hinge 3 ft. 9 in. long, with back strap 2 ft. long, bolted with four $\frac{1}{2}$ in. bolts as before. Hang at bottom with one wrought-iron hinge 4 ft. 2 in. long, cranked, and with eight $\frac{1}{2}$ in. bolts. Each hinge to have a hook with double fangs, let into the hinge stones, and run with lead.

ALTERNATIVE ARRANGEMENT OF THE DESCRIPTION OF DOORS ON THE SECOND FLOOR.

(Compare with "Joiner's Specification, Second Floor.")

DOORS IN DEAL.

Position.	No.	Size.	No. of Panels.	Thickness.	Description.	Pairs.	Butts.	Linings.	Architrave.	Lock.	Furniture.	Other Iron-mongery.	Adjuncts.
		ft. in. ft. in.		in.			in.	in.	in. in.	in.			
Bedrooms 13, 14, 15	3	2 9×6 9	4	2	Moulded both sides	1	3½ iron	1½ double rebated	2½×1¼	6 mortise	Brass	...	...
Bedrooms 11 and 12	2	2 9×6 9	4	2	Moulded both sides	1	3½ iron	1½ double rebated	2½×1¼	6 mortise	Brass	...	2 in. four times rebated transome and 2 in. moulded fanlight in single square fixed.
Housemaid's closet	1	2 9×6 9	4	2	Moulded and square	1	3½ iron	1½ double rebated	2½×1¼	6 mortise	Brass		
Servants' w.c.	1	2 9×6 9	4	2	Moulded and square	1	3½ iron	1½ double rebated	2½×1¼	5 brass mortise latch	Brass	6 in. brass barrel bolt	...
Between front and back passage	1	3 0×7 0	3	2	Moulded both sides, upper panel diminished stiles, with mouldings screwed with brass screws and cups.	...	Archibald Smith's double-action model swing hinges.	2 ovolo moulded both edges and hollowed	2½×1¼	...	...	...	2 brass grip handles P.C. 10s. each.

DOORS IN PITCH PINE.

Position.	No.	Size.	No. of Panels.	Thickness.	Description.	Pairs.	Butts.	Linings.	Architrave.	Lock.	Furniture.	Other Iron-mongery.	Adjuncts.
Bedroom 16, and dressing-room adjoining	3	2 9×6 9	4	2	Moulded both sides	1	3½ brass	1½ double rebated	2½×1¼ deal on one side	P.C. 24s. in all. 6 brass rim	Oval brass	Four brass finger plates, P.C. 1s.6d. each.	...

DOORS IN OAK.

Position.	No.	Size.	No. of Panels.	Thickness.	Description.	Pairs.	Butts.	Linings.	Architrave.	Lock.	Furniture.	Other Iron-mongery.	Adjuncts.
Bedrooms 9 and 10, and boudoir	3	3 0×7 0	5	2	Moulded both sides	1	3½ brass	1½ double rebated, framed and moulded in seven panels the set	2½×1¼ deal one side	P.C. 25s. in all. 6 brass rim	Oval Furniture	Four brass finger plates, P.C. 2s. each.	...

INDEX TO CLAUSES

OF SPECIFICATION OF A HOUSE.

PRELIMINARY AND GENERAL.

PRELIMINARY, ETC.—*continued.*

EXCAVATOR.

DRAINS.

PLASTERER.

FINE PLASTER.

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PORTLAND CEMENT EXTERNALLY.

PLASTERER—*continued.*

GLAZIEP.

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VENTILATION.

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CONSERVATORY—*continued.*

STABLES.

ALTERNATIVE FORM OF INDEX

TO SPECIFICATION OF A HOUSE.

Sometimes the Index, instead of the foregoing, is in the ordinary form of a book index, i.e. alphabetical; it is not necessary or advisable to make more than one reference to each clause.

SECTION IV:

CONDITIONS OF CONTRACT.

Conditions of contract vary greatly. Sometimes a set of such conditions is a heirloom, and, like many other heirlooms, is archaic.

Generally, we may conclude that official sets are the best, as they embody the results of extensive experience. Some of these are the set agreed upon between the Royal Institute of British Architects and the Builders' Society; the set substituted for them in 1895; the sets used by the School Board for London, the Office of Works, the London County Council, the War Department, &c.

As the conditions are legal clauses which affect the whole work they should not be mixed with the specification proper. The essential stipulations of a set of conditions are as follows :—

That the builder shall supply all materials and plant, and do the work according to the drawings and specification; shall give all notices and pay fees to local authorities; shall set out the works, remedy errors, and leave the works clean; shall keep drawings and a foreman on the site; shall not sublet the works; shall maintain the work for a given period; shall insure against fire; shall be responsible for damage; shall reinstate all defects; shall complete within a stated period under penalty; shall furnish accounts of day work within a stated time; shall comply with Acts of Parliament and local regulations; shall be paid at a given rate; may suspend the works in case of non-payment.

That the architect shall furnish the necessary documents; may dismiss offending workmen; may order the removal of objectionable materials or workmanship; shall give certificates; may eject the contractor in certain events; may bring workmen on the ground to do work not in the contract; that disputes shall be referred to a person named; they should also define the

ownership of materials on the ground, and the method of valuing varied work.

Sometimes in the case of small works the architect hesitates to adopt a voluminous set of conditions, but it is probably the safest practice to use the same set in all cases, modifying them in those clauses which relate to money and time of completion in accordance with the extent of the work. When it is remembered that disputes quite as often arise on small as on large works, the precautions will appear to be reasonable.

The conditions should form a part of the specification. The contract can then be quite simple, and instead of embodying the conditions may merely refer to them.

Some architects, however, prefer to exclude the conditions from the specification, making them a part of the contract document. In such a case it may be advisable to repeat some of them in the preliminary clauses of the specification.

General Conditions.—The form of conditions agreed upon between the Royal Institute of British Architects and the Builders' Society is that commonly used. Care must be exercised in filling in the blank spaces left for time of completion, mode of payment, number of days' notice, &c. This set of conditions as commonly filled in by London architects is as follows:—

Some practical considerations are suggested in indented type after some of the conditions. For the purely legal aspects see Emden's "Building Contracts" and Hudson's "Building Contracts," in which books various sets of conditions are criticised, and cases cited which illustrate their interpretation. A *perfect* legal document is, of course, rare, but these conditions serve quite well for ordinary purposes.

General Conditions.

1. The contractors are to provide everything of every sort and kind which may be necessary and requisite for the due and proper execution of the several works included in the contract according to the true intent and meaning of the drawings and specification taken together, which are to be signed by the architect and the contractors, whether the same may or may not be particularly described in the specification or shown on the drawings, provided that the same are reasonably and obviously to be inferred therefrom; and in case of any

discrepancy between the drawings and the specification, the architect is to decide which shall be followed.

Some conditions go even further than this, as follows:—

"Should anything necessary to the perfection of the work have been omitted in either drawings or specification or both of them, the same shall be deemed to be included in the estimated price as if the same had been shown or set forth in both."

When the quantities are to be a part of the contract, insert the words "and quantities" after the word "specification" in the sixth line, so that the clause may read, "according to the true intent and meaning of the drawings, specification, and quantities taken together."

Although the work may be drawn and specified in a way that cannot be carried out, the builder who enters into a contract to complete a given work for a lump sum is bound thereby to adopt practicable methods for completing the work, and the extra expense so incurred cannot be charged as extra on the contract. It is questionable whether the making of the quantities a part of the contract puts the contractor in any better position when the circumstances are as above described.

2. The contractors are to conform in all respects to the provisions and regulations of the Metropolis Local Management Act and the Metropolis Building Act, and to the regulations and by-laws of the London County Council and of the local authorities, and they are to give all notices required by the said Acts to be given to any local authorities, and to pay all fees payable under any of the said Acts to any such authorities, or to any public officer in respect of the works.

The failure of the contractor to pay the district surveyor's fees will, in the event of the district surveyor's failure to recover them, involve their payment by the building owner. In such a case they will be treated as a deduction from the contract sum.

3. The contractors are to set out the whole of the works, and during the progress of the works to amend, on the requisition of the architect, any errors which may arise therein, and upon

request are to provide the necessary appliances, or furnish the necessary vouchers, to prove that the several materials are such as are described. The contractors are to provide all plant, labour, and materials which may be necessary and requisite for the works; all materials and workmanship being the best of their respective kinds; and the contractors are to leave the works in all respects clean and perfect at the completion thereof.

Although this condition makes the contractor responsible for the setting out, it is advisable for the architect or his clerk of works to watch it carefully, as it is often easier to prevent mistakes than to get them rectified.

The clause as to the production of vouchers, as proof of the quality of materials, is nearly always ignored, but when used with judgment is a very useful clause when thoroughly good material is desired.

4. Complete copies of the drawings and specification, signed by the architect, are to be furnished by him to the contractors for their own use, and the same or copies thereof are to be kept on the buildings in charge of a competent foreman, who is to be constantly kept on the ground by the contractors, and to whom instructions can be given by the architect. The contractors are not to sublet the works, or any part thereof, without the consent in writing of the architect.

Some architects stipulate for the return of all drawings, &c., at the completion of the work, thus, "All drawings, tracings, or models used in the production of the building to be returned to the architect, without any copies being kept."

Some conditions absolutely prohibit subletting, but it is very difficult in many cases for an architect to discover whether work is sublet or not. Some builders sublet a very large proportion of a contract; slating, tiling, and plastering are most frequently sub-contracts. The London Trades-Unions are doing their best to discourage the system, and in the course of their operations have treated with great cruelty some of the sub-contractors, many of whom have carried on such a business for many years respectably.

The architect should, whatever he may know as to the

builder's arrangements, take care to avoid any act which may be construed into the adoption of the sub-contractor.

5. The architect is to have at all times access to the works, which are to be entirely under his control. He may require the contractors to dismiss any person in the contractors' employ upon the works who may be incompetent or misconduct himself, and the contractors are forthwith to comply with such requirement.

6. The contractors are not to vary or deviate from the drawings or specification, or execute any extra work of any kind whatsoever, unless the same be required to comply with any of the provisions of any of the Acts of Parliament, regulations, or by-laws hereinbefore mentioned, or unless upon the authority of the architect, to be sufficiently shown by any order in writing, or by any plan or drawing expressly given and signed or initialled by him as an extra or variation, or by any subsequent written approval signed or initialled by him. In cases of day work, all vouchers for the same are to be delivered to the architect or clerk of works, at latest during the week following that in which the work may have been done, and only such day work is to be allowed for, as such, as may have been authorised by the architect to be so done, unless the work cannot from its character be properly measured and valued.

With the question of extra works may reasonably be considered the question of savings and loss of profit. It is obvious that the builder who contracts for a building to cost £20,000 is a loser if the contract is reduced to £10,000. The larger building would cost no more, or very little more, for supervision and establishment charges than the smaller one. Moreover, the builder fails to make the profit on the difference which he might consider assured. Sometimes, when the prices of the builder's estimate are absurdly low, the reduction of the building may prove an advantage rather than a loss to him, but such a case is rare. As a general rule, if the reduction on the total of the final accounts exceeds 15 per cent. of the original contract, a profit should be allowed on the difference between the contract sum and the final total minus 15 per cent.

It will be seen that a new condition published by the

R. I. B. A. stipulates that the contractor shall give notice of an extra before proceeding with it.

7. Any authority given by the architect for any alteration or addition in or to the works is not to vitiate the contract; but all additions, omissions, or variations made in carrying out the works for which a price may not have been previously agreed upon are to be measured and valued, and certified for by the architect, and added to or deducted from the amount of the contract, as the case may be, according to the *schedule of prices annexed, or where the same may not apply at fair measure and value* (or substitute for the words in italics "according to the prices of the original estimate, or where these may not exactly apply at analogous rates, and for this purpose a copy of the original estimate priced out and cast shall be deposited with the architect").

This condition is often made more stringent. The following is an example:—

"If the architect shall decide to make any addition, omission, or deviation from the plans and specification prepared for the work contracted for, the contractor shall not have any authority or claim for such addition or omission unless by an order in writing for every deviation that may be made from the drawings and specification; and if any detail or other drawing delivered to the contractor during the execution of these works shall show work which in his opinion is extra upon the contract, no extra charge for it will be allowed unless the attention of the architect has been called to it and the claim admitted by him before such work is began." Some add "and a price arranged and order given."

Sometimes "No charge whatever will be allowed for extra work, and no such work may be undertaken without an order from the architect in writing, given on receipt of an estimate from the contractor, showing the additional cost of the proposed extra work; and in such order the architect shall state what extra time (if any) shall be allowed for such extra work, and his decision shall be final between the parties, and if no extra time be specified in such order the contractor shall be bound to execute such extra work within the time named in this specification."

Some conditions comprise the following clause about day work:—

"No charge for day work will be allowed under any circumstances."

Or,

"Vouchers for day work shall be delivered (under penalty of not being allowed) in duplicate to the architect or his representative weekly, and shall be signed by him when correct; but such signature is not to be taken as deciding that the work is to be charged as day work, but only as certifying that the time and materials mentioned are correct, as no day work will be allowed for any work which in the surveyor's opinion can be measured and valued."

Another clause which has been fruitful of disaster to builders was a cause of contention in the case of Stevenson *v.* Watson, and is as follows:—

The architect is at all times to have access to the works, which are to be entirely under his control and his clerk of works. The architect may order any additions to or deductions from the contract without in any way vitiating the contract, and the amount of such additions to or deductions from the contract shall be ascertained by the architect in the same manner as the quantities have been measured and at the same rate as they have been priced at.

The contractor and the directors will be bound to leave all questions or matters of dispute which may arise during the progress of the works or in the settlement of the account to the architect, whose decision shall be final and binding upon all parties.

The contractor will be paid on the certificate of the architect.

For comments on this condition see "Fletcher on Quantities" and Leaning's "Quantity Surveying."

8. All work and materials brought and left upon the ground by the contractors, or by their order, for the purpose of forming part of the works are to be considered to be the property of the employer when payment shall have been made of the amount of any certificate in which the value thereof shall be included, and in such case the same are not to be removed or taken away by the contractors, or any other person, without the special

licence and consent of the architect; but the employer is not to be in any way answerable for any loss or damage which may happen to, or in respect of, any such work or materials either by the same being lost or stolen, or injured by weather or otherwise.

There is considerable difference of practice as to advances upon material unfixed. Some architects exclude from their calculations for certificates everything but what is actually fixed in the building; others admit into their calculation the materials on the ground; others go further, and include joinery actually ready at the contractor's workshop.

It is probably safest to confine the calculation to work actually fixed, although, with a Condition like No. 8, there is no danger of loss to the building owner. But so soon as anything further is included a risk is involved which an architect cannot safely adopt, and should not do so without the direct authority of his employer.

When, in conjunction with Condition 8, a specification contains a condition that the whole of the joinery shall be prepared and put together and deposited in a drying-room within a short time of the signing of contract, it may be said that the contractor knows what to expect, but the insistence upon it nevertheless presses somewhat hardly upon him. But the danger of advancing on work not on the site is real. The work may be burned or otherwise injured, the builder may sell it, or he may become bankrupt.

A remedy has been suggested in the establishment of a sort of bonded warehouse, designed in a manner suitable for the storing and seasoning of joinery, where such work might be deposited in the joint names of the building owner and builder, and withdrawn only on the architect's certificate. No doubt under such circumstances advances on joinery might safely be made.

Another question of proportional payments sometimes arises when sums are provided in the contract for the work of specialists, the whole of such persons' bill being paid by certificate on the builder, while the percentage for maintenance is withheld in calculating the builder's certificate. The just course is obviously an arrangement with the specialist which shall involve the retention of a percentage for maintenance similar to that in the general contract.

9. The architect is to have full power to require the removal from the premises of all materials which in his opinion are not in accordance with the specification, and, in case of default, the employer is to be at liberty to employ other persons to remove the same without being answerable or accountable for any loss or damage that may arise or happen to such materials; and the architect is also to have full power to require other proper materials to be substituted; and, in case of default, the employer may cause the same to be supplied, and all costs which may attend such removal and substitution are to be borne by the contractors.

10. Should any of the works be, in the opinion of the architect, executed with improper materials or defective workmanship, the contractors are, when required by the architect, during the progress of the work, forthwith to re-execute the same, and to substitute proper materials and workmanship, and, in case of default of the contractors in so doing within a reasonable time, the architect is to have full power to employ other persons to re-execute the work, and the cost thereof is to be borne by the contractors.

> The exertion of the power given by this clause during the progress of a contract is very difficult, as the contractor in possession can so annoy and obstruct another builder as to make his work almost impossible. There is then no course but his ejectment. If, however, the original contractor leaves the work ostensibly completed, and then disregards a notice, there is no difficulty; for in the event of his refusal or neglect, after notice to put his work right, another contractor may be employed.
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> When an incomplete work is abandoned, as sometimes happens, or in case of an ejectment, it is not always easy to induce another builder to contract for its completion; a not unnatural *esprit de corps* deters many of the more respectable builders from dealing with it.

11. Any defects, shrinkage, and other faults, which may appear within six months from the completion of the building, and arising out of defective or improper materials or workmanship, are, upon the direction of the architect, to be amended and made good by the contractors at their own cost, unless the architect

shall decide that they ought to be paid for the same; and, in case of default, the employer may recover from the contractors the cost of making good the works. See also Appendix note on Condition 17.

12. The contractors are to insure the building against loss or damage by fire in an office to be approved, in the joint names of the employer and contractors, *for half the value of the works executed, until it shall be covered in, and thenceforth until completion in three-fourths of the amount of such value* (or substitute for the words in italics "from commencement until completion for the full amount of contract"); and are, upon request, to produce to the architect the policies and the receipts for the premiums for such insurance. All moneys received under any such policies are to be applied in or towards the rebuilding or reparation of the works destroyed or injured. In case of neglect the employer is to be at liberty to insure and deduct the amount of the premiums paid from any moneys payable to the contractors.

13. The building, from the commencement of the works to the completion of the same, is to be under the contractors' charge; they are to be held responsible for, and to make good, all injuries, damages, and repairs occasioned or rendered necessary to the same by fire, or causes over which the contractors shall have control, and they are to hold the employer harmless from any claims for injuries to persons, or for structural damage to property happening from any neglect, default, want of proper care, or misconduct on the part of the contractors, or of any one in their employ, during the execution of the works.

14. The employer is at all times to have free access to the works, and is to have full power to send workmen upon the premises to execute fittings and other works not included in the contract, for whose operations the contractors are to afford every reasonable facility during ordinary working hours, provided that such operations shall be carried on in such a manner as not to impede the progress of the work included in the contract; but the contractors are not to be responsible for any damage which may happen to or be occasioned by any such fittings or other works.

15. The contractors are to complete the whole of the works (except painting and papering, or such other works as the architect may desire to delay) within twelve calendar months after

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the commencement of the same, unless the works be delayed by reason of any inclement weather, or causes not under the contractors' control, or in case of combination of workmen, or strikes, or lock-out, affecting any of the building trades, for which due allowance shall be made by the architect, and then the contractors are to complete the works within such time as the architect shall consider to be reasonable, and shall from time to time in writing appoint, and, in case of default, the contractors are to pay or allow to the employer as and by way of liquidated and agreed damages the sum of £10 per week for every week during which they shall be so in default, until the whole of the works (except as aforesaid) shall be so completed, provided the architect shall in writing certify that the works could have been reasonably completed within the time appointed.

It is the opinion of some architects that a condition which arranges the exact period of extension of time proportioned to the increased quantity of work is preferable to the foregoing. A common form is as follows:—

The works comprised in this contract are to be commenced immediately upon the execution of the contract, when possession of the site can be had. The roofs of the buildings shall be on and completed and the whole covered in from rain within eight calendar months of the signing of the contract, and the whole of the said work, including all such additions and variations as aforesaid (but excluding such, if any, as may have been postponed by an order from the architect), shall be completed in every respect within twelve calendar months of the signing of the contract; and if from any cause whatever other than wilful obstruction or default on the part of the building owner or the architect, and except as hereafter provided the whole of such work, including as aforesaid, shall not be finished to the satisfaction of the architect within the said period, the contractor shall forfeit and pay to the building owner by way of ascertained and liquidated damages for each default, and not by way of penalty, the sum of ten pounds per week for every complete week of such default; and the amount of such damage, if any, may be deducted by way of set-off from any unpaid portion of the contract price, or otherwise recovered from the contractor, and shall be brought into account by

the architect when settling the contract accounts for his final certificate hereinafter provided for.

Provided nevertheless that if the contractor shall be of the opinion that he is entitled to any extension of time on account of the works being altered, varied, or added to, or on account of any delay by reason of any inclement weather or causes not under the control of the contractor, or in consequence of any combination of workmen, strikes, or lock-out affecting any of the building trades engaged, or in consequence of orders to that effect from the architect himself, which orders the architect is hereby empowered to give, then, in any or either of such cases it shall be competent for the architect, by a certificate under his hand, to extend the aforesaid period for final completion by such period or periods as he shall deem reasonable, and the contractor is to complete the works within such extended period or periods as aforesaid. Provided always that such extension shall not in the case of alterations or variations or additional work exceed the period of seven days for every three hundred pounds' worth of such altered, varied, or additional work, and shall not exceed in the case of a suspension of said contract work the actual period of such suspension; provided that the contractor shall not be entitled to any extension of time unless he shall within three days after the happening of the event in respect of which he shall consider himself entitled to any extension give to the architect written notice of such claim to an extension of time, and of the ground or grounds and of the amount thereof, unless in any case the architect shall in his discretion dispense with such notice and certify for an extension of time; nevertheless, and in case of any extension of time, the aforesaid provisions, with amount for damages in default of due completion, shall apply in case of non-completion of the works within the extended time.

There is always a considerable difficulty in enforcing penalties. The contractor will allege that he has been hindered in various ways; that the building owner or clerk of works has vexatiously interfered with his work; that the architect has kept him waiting for general drawings or details; that the extra work has involved an undue expenditure of time. Either of these contentions are often difficult

to disprove. A diary carefully kept by architect and clerk of works respectively, with notes of weather, of the progress of the building, the dates of receipt of instructions of general drawings and details of rejection of improper materials, delays in delivery of materials, stoppage of the works, &c., are almost certain to prove useful. All instructions and remonstrances should be in writing, and every document should be dated.

16. If the contractors shall become bankrupt, or compound with or make any assignment for the benefit of their creditors, or shall suspend or delay the performance of their part of the contract (except on account of causes mentioned in Clause 15, or on account of being restrained or hindered under any proceedings taken by parties interested in any neighbouring property, or in consequence of not having proper instructions for which the contractors shall have duly applied), the employer, by the architect, may give to the contractors or their assignee or trustee, as the case may be, notice requiring the works to be proceeded with, and in case of default on the part of the contractors or their assignee or trustee for a period of seven days, it shall be lawful for the employer, by the architect, to enter upon and take possession of the works, and to employ any other person or persons to carry on and complete the same, and to authorize him or them to use the plant, materials, and property of the contractors upon the works; and the costs and charges incurred in any way in carrying on and completing the said works are to be paid to the employer by the contractors, or may be set off by the employer against any moneys due, or to become due, to the contractors.

The powers given by this condition should not be exercised without very careful consideration. In the event of the builders' bankruptcy there is in many cases no alternative to the employment of another contractor. If a trustee be appointed to complete the works of the first contractor it is generally the most favourable arrangement for the building owner, as it is never possible to complete the works by a second contractor for the balance of the original contract amount.

Moreover the delay consequent upon the mere stoppage of the work, the time expended in measuring and valuing the

work done up to the time of such stoppage, and possibly in addition the preparation of quantities for the remaining work of the original contract, besides the possibility of litigation as to value, afford strong reasons for caution.

17. When the value of the works executed and not included in any former certificates shall from time to time amount to the sum of £500 or otherwise, at the architect's reasonable discretion, the contractors are to be entitled to receive payment at the rate of 80 per cent. upon such value until the difference between the percentage and the value of the works executed shall amount to 10 per cent. upon the amount of the contract, after which time the contractors are to be entitled to receive payment of the full value of all works executed and not included in any former payment, and the architect is to give to the contractors certificates accordingly; and when the works shall be completed, or possession of the building shall be given up to the employer, the contractors are to be entitled to receive one moiety of the amount remaining due, according to the best estimate of the same that can then be made, and the architect is to give to the contractors certificates accordingly, and the contractors are to be entitled to receive the balance of all moneys due or payable to them under, or by virtue of, the contract within six months from the completion of the works, or from the date of giving up possession thereof to the employer, whichever shall first happen. The contractors are to be entitled to receive any sum reserved for painting and papering, or otherwise, on the completion thereof. Provided always that no final or other certificate is to cover or relieve the contractors from their liability under the provisions of Clause No. 11, whether or not the same be notified by the architect at the time or subsequently to granting any such certificate.

This condition affords scope for very great variety of treatment.

The old form of this condition provided for payments at different stages of the progress of the building something like the following, extracted from Bartholomew's "Specifications," 1840:—

Payment of the consideration for the due performance of the works, matters, and things hereby intended to be done, and for any extra works which may by the aforesaid architect

be ordered, is to be made to me by the said after the following manner, that is to say, within fourteen days after I shall have produced to him a certificate signed by the aforesaid architect, stating that the carcase work of the buildings is carried up to the height of the one pair storey thereof, and that the timbers of the one pair flooring thereof are laid and fixed, he, the aforesaid , shall pay to me the sum of . That within fourteen days after I shall have produced to him a like certificate, signed by the aforesaid architect, stating that all the carcase work and the roofs and gutters of the buildings are complete, he, the aforesaid , shall pay to me the further sum of . That within fourteen days after I shall have produced to him a like certificate, stating that all the intended works, matters, and things are completed (except the painting as aforesaid, and except the colouring, whiting, and paperhanging to the plastering, and except also), he, the aforesaid , shall pay to me the further sum of ; and, lastly, that within four calendar months after I shall have produced to him a like certificate, signed by the aforesaid architect, stating the whole of the works, matters, and things of every kind hereby intended to be done are wholly completed, he, the aforesaid , shall pay to me the full balance of the monies to become due to me for the full performance of the said intended works, matters, and things; subject however to this especial proviso, that in case any blemishes, failures, or imperfections shall before the payment of the said final balance appear in any of the said works, matters, and things hereby intended to be done, that I shall nevertheless amend and make good at my own cost, to the satisfaction of him the aforesaid architect, all such blemishes, failures, or imperfections as though I had never produced the aforesaid certificate. Provided always that the payment of such balance so to be left as aforesaid is not to protect me, the said , from any liabilities that I may justly be subject to at any time on account of my not having well and sufficiently performed all that I have above contracted to do; provided also that in case I, the said , shall at any time before the full completion of the said works, matters, and things improperly delay the execution thereof, it shall be competent to the said architect, on giving to me fourteen

days' notice in writing of his intention so to do, to employ any other person or persons to complete the same, and in that case all such sums as shall have to be paid to such other person or persons so completing the said works, matters, and things shall be deducted from the sum to be paid to me as above mentioned, and in case such sum shall not be sufficient, I hereby agree to pay to the said any deficiency which may thence arise.

The National Association of Master Builders of Great Britain advocates the making the quantities a part of the contract, and adopts the following condition:—

The proprietor shall pay to the contractor for the full and perfect completion of this contract the sum of £ . But if the architect shall direct any addition to or omission of, or variation from the works, the value of such addition, omission, or variation shall be added to or deducted from the said sum of £ as provided in Clause 8 as the case may be; and if there should be found to be any error in the quantities supplied, such error shall be rectified, and an addition be made to the contractor or deducted from him as the case may be in respect of such error.

Clause 8 above referred to is practically the same as Clause 7 of the Royal Institute conditions.

18. A certificate of the architect, or an award of the referee hereinafter referred to, as the case may be, showing the final balance due or payable to the contractors, is to be conclusive evidence of the works having been duly completed, and that the contractors are entitled to receive payment of the final balance, but without prejudice to the liability of the contractors under the provisions of Clause No. 11.

A final certificate is often unduly and unjustly delayed for the completion of a number of very small items of work, and it is important to observe that such delay practically involves the lengthening the period of maintenance, and puts off the payment of the moiety of the balance usually paid on completion.

The astute builder in such a case presses for a certificate of completion as soon as the works of the original contract are completed, and in default refuses to give up possession of

the building until he gets it. And as it is frequently the case that the building owner is anxious to enter upon his occupation at as early a date as possible, the builder generally gains his point.

19. If the employer shall make default in paying any moneys to which the contractors may become entitled for fourteen days after the amount thereof shall have been certified, or if the works be delayed for three months by or under any proceedings taken by any other parties, the contractors are to be at liberty to suspend the works, and to require payment for all works executed and all materials wrought-up, and for any loss which they may sustain upon any goods or materials purchased for the works and in such case the contractors are not to be bound to proceed further with the works contracted for. The contractors are to be entitled to such interest and at such rate as the architect shall certify upon all moneys payable to the contractors, payment of which may have been unduly delayed.

20. Provided always that in case any question, dispute, or difference shall arise between the employer (or the architect on his behalf) and the contractors as to what additions, if any, ought in fairness to be made to the amount of the contract by reason of the works being delayed through no fault of the contractors, or by reason or on account of any directions or requisitions of the architect, involving increased cost to the contractors beyond the cost properly attending the carrying-out the contract according to the true intent and meaning of the signed drawings and specification, or as to the works having been duly completed, or as to the construction of these presents, or as to any other matter or thing arising under or out of this contract except as to matters left during the progress of the works to the sole decision or requisition of the architect under Clauses Nos. 1, 9, and 10, or in case the contractors shall be dissatisfied with any certificate of the architect under Clause No. 7, or under the proviso in Clause No. 15, or in case he shall withhold or not give any certificate to which they may be entitled, then such question, dispute, or difference, or such certificate, or the value or matter which should be certified, as the case may be, is to be from time to time referred to the arbitration and final decision of   , architect; or in the event of his death or unwillingness to act, then of   , architect; or in the event of his death or

unwillingness to act, then of an architect being a Fellow of the Royal Institute of British Architects, to be appointed on the request of either party by the President for the time being for such Institute, and the award of such referee is to be equivalent to a certificate of the architect, and the contractors are to be paid accordingly.

21. Upon every or any such reference the costs of and incidental to the reference and award respectively shall be in the discretion of the referee or arbitrator, who may determine the amount thereof or direct the same to be taxed, as between solicitor and client, or as between party and party, or otherwise, and may award or direct by whom and to whom and in what manner the same shall be borne and paid; and this submission may be made a rule of any division of the High Court of Justice upon the application of either party, who may instruct counsel to consent thereto for the other party without any notice being given to such party.

The above form of condition presupposes the insertion of a name before the contract is signed. It is the opinion of many that the appointment should be deferred until a dispute arises, so that the arbitrator who may be selected shall be properly qualified to deal with the particular issue. This clause also provides that the arbitrator shall be an architect; but in questions of quantity and value of artificers' work, which is most frequently the class of question upon which disputes arise, the quantity surveyor is the most capable judge; indeed, in many cases the ostensible decision of the architect arbitrator is really the decision of his quantity surveyor. Probably the most desirable arbitrator is one who, in addition to an architectural training, has been educated as a quantity surveyor—the latter is essential to the methodical and close analysis which most building disputes require.

Arbitration is peculiarly convenient for the settlement of building disputes, but the selection of the arbitrator requires much more careful consideration than it often gets.

When a contract does not contain an arbitration clause a dispute usually induces an action at law; if the dispute is not a matter of accounts, it can often be quite easily settled by the ordinary courts, but when measurement and valuation

is involved the court will either suggest to the parties to the action an agreement as to a particular person to whom the matter shall be referred, or will refer it to one of the official referees. These are possibly good lawyers, but their decisions on questions of the conduct of building operations, or on quality and value of materials, often reduce one litigant or the other to a condition of blank amazement.

When the dispute refers to the interpretation of a contract or conditions there is very little doubt that a lawyer is the best referee.

When the dispute is a matter of measurement and valuation a quantity surveyor should be selected. As a rule the training of the architect has not fitted him for the work for measurement and valuation; he often depends on his quantity surveyor, a consideration which affords reasonable ground for going directly to the quantity surveyor.

Even this course does not always result in logical procedure, or the adoption of a broad view of the case.

The builder has perhaps delivered an account, often prepared with a puzzle-headed absence of method which is very difficult to check, but still more difficult in its existing form to argue upon with any hope of convincing the arbitrator. At this stage, the ordinary method of preparing a counter statement with items parallel to the original ones is almost impossible. The counsel on each side pick out items from their connection and argue upon them, to the confusion of all concerned, including the arbitrator. In such a case it would be much simpler to begin the investigation of the accounts anew. The arbitrator insisting on the appointment of a measuring surveyor by each litigant, directing them to proceed in the ordinary manner adopted for the amicable settlement of a building account; in such a process the general measurements would be settled between the surveyors; and where there was a doubt as to an item, an appeal to the arbitrator would promptly adjust it. The measurements being completed and a bill produced, the prices would be attached by each of the surveyors to a similar account, and these two accounts when laid before the arbitrator would enable him to settle the differences of rates.

The failure to adopt this plain and reasonable course, sanctioned by common sense and long usage, is sufficient to account for the waste of time, the heavy costs, and the unsatisfactory results of so many building arbitrations.

When an architect is the arbitrator, and sits with a legal assessor, it is very frequently equivalent to a reference to a lawyer.

Either architect or quantity surveyor should sit alone and reserve legal questions for a consultation with his solicitor.

If the architect will not tolerate an arbitration clause the alternative is to adopt some such condition as the following:—

All questions between the contractor and employer and between the contractor and architect touching all matters and things relating to this contract shall be left to the sole determination or award of the architect, and the parties aforesaid respectively shall abide by, perform, and keep the said determination or award; and this submission may be made a rule of any division of the High Court of Justice upon the application of either party, who may instruct counsel to consent thereto for the other party without any notice being given to such party.

Rate of Wages.—If the architect thinks he has a right to interfere with the freedom of contract between the contractor and his men he may introduce a condition something like the following:—

"The contractor shall pay to all persons engaged by him in carrying out the works such wages as are generally accepted as current in the locality in each trade for competent workmen, and shall from time to time, whenever required so to do, produce to the architect sufficient evidence that such wages are paid by him, and also that none of the work is sublet."

Or,

"Where the London scale of wages shall apply, the contractor shall pay to the workmen employed by him not less than the minimum standard rate of wages in each branch of the trade. In all other districts where the minimum rate of wages shall not apply, the contractor shall pay the workmen and all other persons employed by him in connection with his contract not less than the minimum standard rate of wages which may

for the time being be usual and generally paid where such workmen are employed."

Sureties.—When sureties are required a condition something like the following will be necessary:—

"The contractor shall send in with his tender the names of two responsible sureties, who shall be jointly liable with him in the sum of £   for the due completion of the contract, and the bond to be executed on the signing of the contract."

Or,

"The contractor will be required to give security for the due performance of the contract by bond of two sureties jointly and severally bound in the sum of £   ."

Sureties should always be bound "jointly and severally."

Provisional Sums.—It is sometimes reasonable and convenient for the building owner to pay direct for work which is the subject of a provisional amount, and some architects use the following condition:—

In all cases of provisional amounts for specific items, the architect shall be at liberty to pay such sums directly to the tradesman he may employ to do such work and to deduct the sum provided for it from the amount of the contract.

Or,

Special Tradesmen and Quantity Surveyor.—The contractor is from time to time forthwith to pay to the firms named in the specification, or hereafter appointed by the architect, to execute the works for which certain provisional sums are provided in the specification a proportionate sum on account of the works executed by them and included in the value of the works certified for: also to pay to the quantity surveyors the amount of their charges as stated in the bills of quantities out of the first certificate in which the same will be included. The contractor is from time to time to produce to the said architect, if desired, the receipts for all such several payments before another certificate is granted, and the architect is to be at liberty to withhold the certificate if such receipts are not produced; or if the architect think fit he may direct that the said provisional sums, or any of them, be retained out of the contract amount, and may certify to the building owners separately for the works for which such provisional sums are provided in order that the firms executing such works may be paid by the building owners direct.

If the architect desires to keep down the cost of the work he should avoid the specialists and put the whole of it into the general contract.

Night Work.—When work is carried on both day and night some such condition as the following may be necessary, although the decision as to the times at which the work shall be done rests with the contractor. A contract to do the work within a very short time will certainly involve night work.

If the work be carried on during the night as well as the day, it shall be done by two sets of men working as a day and night shift respectively. No man shall work longer than the general body of men composing the shift to which he belongs, and two foremen shall be employed, one connected with each shift, and remaining thus connected with such shift during the whole progress of the work.

When the work is a small one, a shorter synopsis of the desired conditions is sometimes used instead, something like the following :—

Discrepancies between Documents.—The contractor to supply all labour and materials shown on the drawings or described on the specification, or which may reasonably be inferred therefrom, and in case of any discrepancy between the drawings and the specification, the architect shall decide which shall be followed.

Fees, &c.—The contractor shall conform to all local acts or by-laws, shall give all notices, supply any drawings or information that may be required by the local authorities, and pay any fees legally payable.

Foreman Subletting.—The contractor to keep an approved foreman on the works, and not to sublet the works except by architect's permission.

Day Works.—All vouchers for day works shall be delivered during the week following that in which the work may have been done, and no day work shall be paid for which has not been ordered in writing by the architect.

Maintenance.—Any defects, shrinkage, or other faults which may appear within six months from completion shall be made good by contractor at his own cost.

Insurance.—The contractor to insure building from fire from commencement until completion for the full amount of contract, *or the proportion of insurance to cost may be apportioned to the various stages of the progress of the building.*

Time for Completion.—The contractor to complete the works within three calendar months of the date of signing contract, and in case of default shall pay or allow to employer, as and by way of liquidated and agreed damages, the sum of £5 per week for every week during which he shall be so in default.

Bankruptcy, &c.—If the contractor shall become bankrupt, or compound with or make any assignment for the benefit of his creditors, or shall suspend or delay the works, the employer, by the architect, may give to the contractor or his representatives notice requiring the works to be proceeded with, and in case of his default for a period of seven days, it shall be lawful for the architect to take possession of the works, and the property of the contractor upon the works, and to employ any other persons to complete the building at the contractor's expense.

Payments.—Payments shall be made to the contractor at the rate of 80 per cent. upon the value of the works done and materials on site, in sums of not less than £100 at the architect's discretion, until the difference between that percentage and the work executed amounts to 10 per cent. on amount of contract, after which payment will be made in full, one moiety of the remainder to be paid at completion of works, and the balance six months afterwards.

Valuing Extras and Omissions.—The contractors shall deposit with the architect a fully priced copy of the quantities (or original estimate), and extras and omissions shall be valued at the rates of the original estimate, any item of extra work which does not exactly agree with the description of the original estimate to be valued at a price analogous thereto.

Or a clause like this following is sometimes used when the quantities are part of the contract (when they are not it is better to avoid reference to them in the specification) :—

The bills of quantities will form the basis of the contract, and duplicate bills will be supplied to the contractor whose tender is accepted to fill in the prices of his original estimate, and extras and omissions will be valued at those rates.

Local Acts.—Familiarity with the London Building Act is necessary for London work. When the work is in the country, the local by-laws should be examined, and in either case any necessary clauses should be inserted in the specification, or the work so described as to be in accordance with them.

REVISED CONDITIONS OF CONTRACT ISSUED JULY 25, 1895, BY THE ROYAL INSTITUTE OF BRITISH ARCHITECTS.

The conditions of contract agreed upon between the Royal Institute of British Architects and the Institute of Builders (see page 171), having been criticised with severity by legal authorities, although they have been extensively used, and in the majority of cases without any ensuing litigation, the practice committee of the Royal Institute of British Architects, which has for several years been engaged upon their revision and upon the necessary negotiations with the Institute of Builders, has at length issued the following revised document. The exhaustive debate upon it is recorded in their Journal, and may be profitably studied by persons interested in building contracts.

Its official adoption by the Institute of Builders, who, it is believed, were favourable to all the clauses except the arbitration clause, is at present withheld, the main reason being their desire to insert the following clause in place of that adopted by the architects, maintaining that many points in the earlier clauses could only be agreed to subject to the clause in dispute, which is as follows:—

Provided always that in case any dispute or difference shall arise between the employer or the architect on his behalf and the contractors either during the progress of the work or after an entry under Clause 26, or after the determination, abandonment, or breach of the contract, as to the construction of the contract, or as to any matter or thing arising thereunder, including and in addition (*a*) the right to exercise, and the exercise by the architect or the employer of any power conferred upon them or either of them (except as to the matters left during the progress of the works to the sole discretion of the architect under Clauses 4, 9 and 19, and the exercise by him under Clause 18 of the right to have any work opened up) ; (*b*) the withholding by the architect of any certificate or decision or the failure to express any opinion

or approval to which the contractors shall claim to be entitled under the contract; (*c*) the nature, terms, and reasonableness or otherwise of any certificate, finding, decision, requisition, or opinion of the architect under the contract, and the time of the giving thereof, as to which the contractors shall be dissatisfied (except those relating to the matters and the right excepted above); (*d*) as to what additions (if any) ought in fairness to be made to the amount of the contract by reason of the works being interfered with, delayed, or stopped, either through no fault of the contractors or by any fault or default of the employer or any of his representatives, or by reason or on account of any decision, direction, or requisition of the architect, or failure on the part of the architect to give any decision or direction involving increased cost to the contractors beyond the cost properly attending the carrying out of the contract according to the true intent and meaning of the signed drawings and specification, but without prejudice to Clause 12 thereof; (*e*) any claim by the contractors for work done or goods supplied in connection with the works, though outside the contract, and all other claims of whatever kind by the contractors on the employer in connection with the subject matter or arising out of this contract or any breach thereof, such dispute or difference shall be and is hereby referred to the arbitration and final decision of   ; or, in the event of his death or unwillingness or inability to act, of   ; or in the event of his death, unwillingness or inability to act, of a person to be appointed on the request of either party by the President for the time being of the Royal Institute of British Architects, and the award of such arbitrator shall be final and binding on the parties. No matter or thing (except as aforesaid) shall be deemed to be concluded by the terms of any certificate, opinion, decision, requisition or notice given by the architect, and the arbitrator shall have power to open up and review any such certificate, opinion, decision, requisition and notice (save in regard to the said matters expressly excepted above), and to determine all matters in dispute which shall be submitted to him, whether such certificate, opinion, decision, requisition, or notice has been acted upon or complied with or not, and if acted upon or complied with by the contractors, to determine the amount payable to the contractors in consequence thereof. Upon every or any such reference the costs of and incidental to the reference and award respectively shall be in the discretion of the arbitrator, who may determine

the amount thereof or direct the same to be taxed as between solicitor and client or as between party and party, and shall direct by whom and to whom and in what manner the same shall be borne and paid. This submission shall be deemed to be a submission to arbitration within the meaning of the Arbitration Act, 1889.

The rearrangement in the new published conditions of the numbers of the draft conditions which are referred to in the foregoing clause have made it necessary to alter the numbers in that clause, but with these exceptions, it is as proposed.

Some of the reasons adduced for the rejection of the former set of conditions may be repeated here.

That some of the clauses were obsolete, owing to alterations in the law, and others appeared to need adaptation to modern requirements.

That the very important bankruptcy clause was illegal as framed, and its presence in a contract rendered the whole deed invalid.

In the new conditions there is no specific bankruptcy clause, the power to take possession and complete the work is given by the clause relating to stoppage of building for any cause.

It will be seen that the conditions are put into the form of a contract instead of heads of conditions. This appears to have been done at the instance of the builders.

A Form of Agreement and Schedule of Conditions for Building Contracts.

Note.—This form is applicable where quantities do not form part of the contract, and requires to be varied and to have the blanks filled in to meet the special circumstances of each contract.

W. Emerson, *Hon. Secretary.*
William H. White, *Secretary.*

25*th July*, 1895.

Articles of Agreement made the day of 189 Between of in the County of (hereinafter called "the employer") of the one part and of and of in the county of builder[1] (hereinafter called "the contractor")

[1] Insert "s and co-partners" if such is the fact.

of the other part. WHEREAS the employer is desirous of[1] a messuage and premises at and has caused drawings and a specification describing the work to be done to be prepared by of , his architect; AND WHEREAS the said drawings numbered 1 to inclusive and the specification marked "A" have been signed by or on behalf of the parties hereto: AND WHEREAS the contractor has agreed to execute upon and subject to the conditions set forth in the schedule hereto (hereinafter referred to as "the said conditions") the works shown upon the said drawings and described in the said specification for the sum of £ : NOW IT IS HEREBY AGREED AS FOLLOWS:—

1. In consideration of the sum of £ to be paid at the time and in the manner set forth in the said conditions, the contractor will, upon and subject to the said conditions, execute and complete the works shown upon the said drawings, and described in the said specification.

2. The employer will pay the contractor the said sum of £ or such other sum as shall become payable hereunder at the times and in the manner specified in the said conditions.

3. The term "the architect" in the said conditions shall mean the said or, in the event of his death or ceasing to be the architect for the purpose of this contract, such other person as shall be nominated for that purpose by the employer, not being a person to whom the contractor shall object for reasons considered to be sufficient by the arbitrator mentioned in the said conditions. Provided always that no person subsequently appointed to be architect under this contract shall be entitled to disregard or overrule any decision or approval or direction given or expressed by the architect for the time being.

4. Any reference in the said conditions to the bills of quantities shall not have the effect of constituting them part of this contract.

5. The said conditions shall be read and construed as forming part of this agreement, and the parties hereto will respectively abide by and submit themselves to the conditions

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[1] Insert "erecting" or "restoring" or "adding to" as the case may be.

and stipulations, and perform the agreements on their parts respectively in such conditions contained.

As witness our hands this day of 189 .

Signed in the presence of

The proviso at the end of Article 3 has been objected to, but so long as the architect is the architect of the building the employer ought to be responsible for whatever that architect does, and if a subsequent architect comes in and disagrees with what has been done he can only treat it as a variation under the contract, and pay the builder for altering it.

Schedule of Conditions.

Drawings and Specification.—1. The works shall be carried out in accordance with the directions, and to the reasonable satisfaction of the architect in accordance with the said drawings and specification, and in accordance with such further drawings, details, and instructions, in explanation of the same as may from time to time be given by the architect. The contract drawings and specification shall remain in the custody of the architect, and shall be produced by him at his office as and when required by the employer or by the contractor.

Copies of Drawings and Specification.—2. One complete copy of all drawings and of the specification, shall be furnished by the architect free of cost to the contractor for his own use. The architect shall furnish to the contractor, within days after the receipt by him of a request for the same, any details which in the opinion of the architect are necessary for the execution of any part of the work, such request to be made only within a reasonable time before it is necessary to execute such work in order to fulfil the contract. Such copies and details shall be kept on the works until the completion thereof, and the architect, or his representative, shall at all reasonable times have access to the same, and they shall be returned to the architect by the contractor on the completion of the contract.

It may be necessary, in some cases, to modify this clause. The general custom is the supply by the architect of one copy of the drawings and specification to the contractor. Extra copies should be charged to the employer.

Some architects use a clause like the following:—

"The contractor shall provide at his own cost two complete sets of the general drawings and specification for himself, another and separate copy for the Clerk of Works, and any drawings required by the district surveyor."

It will be seen that no attempt has been made to settle the contentious question of the ownership of the drawings; this might have been done by altering the clause, "the contract drawings," &c., to "The contract drawings and specifications shall remain the property of and in the custody of the architect," &c.

Copy of Estimate.—3. The contractor shall on the signing hereof furnish the architect with a verified[1] copy of the original estimate for his sole use or that of the surveyor appointed as in Clause 13 hereof, and for the purposes only of this agreement.

This clause is not quite so clear as it might be. The words "*verified* copy" appear to require interpretation as to method of verification, and by whom it shall be verified. The usual practice is the employment of the quantity surveyor, who took out the quantities to examine the original estimate. He tests all the extensions and casts, and especially observes the treatment of the summary, the amount of which is sometimes modified by a percentage before the amount is carried to the tender. When any errors of magnitude or striking peculiarity of price are observed the architect should be informed of them. If the contractor has made a great error of omission he should, if he declines to ignore it, be permitted to withdraw his tender. If he has made an error of excess he should be called upon to amend it, and if he refuses, it will then become a question whether the next lowest tender shall be accepted or not. These considerations strengthen the arguments for the invariable use of the clause in the invitation to tender: "The building owner does not bind himself to accept the lowest or any tender."

This clause would be made clearer by the addition of the words, "and the surveyor above-mentioned shall examine and verify the bills of quantities before the signing of the contract."

[1] The word "sealed" to be inserted if so agreed.

The stipulation that the deposited bill of quantities shall be sealed does not preclude the examination of the bill. It may be, and generally is, sealed afterwards.

When the bill of quantities or original estimate in another form is to serve as a schedule of prices for the valuation of extras and omissions, it is important that the examination should be made *before* the contract is signed; for besides the possibility of a considerable error in the mere extensions or costs, there are ways of pricing items which are palpably fraudulent, or mistakes of pricing, such as adopting for brickwork extra only in cement the rate of brickwork in cement. And sometimes builders insert clauses which alter the sense of particular items, such as "this price does not include for cartage of plant," or "allowance for sand, gravel, &c., £300," and the like. If the examination is postponed until the time arrives to settle the accounts, the object of the examination is partially defeated, as in a case when a bill was deposited but found to have no prices attached. In rare cases the builder professes that he never used the quantities at all. The invitation to tender may request that each contractor deposit with *his tender* his priced estimate, and the arrangement should also be comprised in one of the conditions of contract. The School Board for London uses the following:—

"A copy of the bills of quantities fully priced and moneyed out, which are to form part of this contract, are to be deposited with the Works Department by the contractor on the signing of the contract, to be used as a schedule of prices, and for measuring and valuing the extras and omissions, if any, upon the contract."

"In adjusting extras or variations upon the contract, the Board's measuring surveyor will measure on the same basis as that on which the quantities are taken, and all labours not specially mentioned in the quantities will be taken as included in the prices of the various items."

The Board, however, insists upon the deposit of the original estimate sealed with each tender, the copy belonging to the builder whose tender is recommended for acceptance is then opened and examined, and the others returned to their owners. If the bill is found to be satisfactory the tender is then signed.

The War Department uses the following clause in its invitation to tender:—

"The priced bills of quantities fully marked on the cover so as to secure identification should at the same time be transmitted as a separate packet."

Another Government department, whose quantities do not form a part of the contract, and who do not seal them, uses the following:—

"Extras and omissions will be valued on a schedule based upon the price of contract, for which purpose the builder is to furnish the architect with a copy of this estimate fully priced and moneyed out, and to satisfy him of its authenticity and accuracy."

It is the practice with some to have a copy of the priced bill made for the purpose of a schedule, omitting the quantities (the number of feet, yards, &c.) and the extensions.

Many public bodies insist upon the deposit of the complete copy of original estimate, with the tender of each contractor, and use some such condition as the following:—

"The bills of quantities which are deposited by the contractor with his tender are to become the property of the local board, and the prices placed against the various items in such bills of quantities shall be the same as those upon which the said tender is based and accepted, and any defect, omission, or error in the sealed copies shall be rectified by the architect, and the value of all omitted and diminished works and extra works, to be from time to time executed under this contract shall be regulated and determined by the architect in accordance with the prices set out in the aforesaid sealed copies of the quantities. Provided that this clause shall not have the effect of constituting the bills of quantities part of this contract, but shall authorize the use of the bills of quantities for the purpose only of regulating the prices or values of omitted, diminished and extra works."

The condition, therefore, if it is to be clear, comprehensive, and useful, should comprise the following requirements:—

The deposit of the priced bill of quantities before the signing of the contract (preferably with the tender). Its examination and comparison with the copy intended for sealing before signing the contract, a statement of who shall examine it—that the sealing shall be after the examination.

Contractor to provide everything necessary.—4. The contractor shall provide everything necessary for the proper execution of the works, according to the true intent and meaning of the drawings and specification taken together, whether the same may or may not be particularly shown on the drawings or described in the specification, provided that the same is reasonably to be inferred therefrom ; and if the contractor find any discrepancy in the drawings, or between the drawings and specification, he shall immediately refer the same to the architect, who shall decide which shall be followed. Figured dimensions are to be followed in preference to the scale.

> It has been suggested that the addition of the following would make this clause more complete, "and detailed or explanatory drawings in preference to the said signed contract drawings, or any others supplied to a smaller scale."

Local and other Authorities; Notices, &c.—5. The contractor shall conform to the provisions of any Acts of Parliament relating to the works, and to the regulations and by-laws of any local authority, and of any water and lighting companies with whose systems the structure is proposed to be connected, and shall, before making any variation from the drawings or specification that may be necessitated by so conforming, give to the architect written notice, specifying the variation proposed to be made, and the reason for making it, and apply for instructions thereon. In case the contractor shall not in due course receive such instructions he shall proceed with the work, conforming to the provision, regulation, or by-law in question, and any variation so necessitated shall be dealt with under Clause 13. The contractor shall give all notices required by the said Acts, regulations, or by-laws to be given to any local authority, and pay all fees payable to any such authority, or to any public officer in respect of the works.

> This clause and Clause 4 settles a question sometimes in doubt, for a building contract has been held to be an undertaking to produce a complete building, although the drawings and specification may imperfectly express the architect's intentions, the extra work would be paid for under Clause 12.

Setting out of work.—6. The contractor shall set out the works, and during the progress of the building shall amend at his own

cost any errors arising from inaccurate setting out, unless the architect shall decide to the contrary.

Materials, &c. to conform to Specification.—7. All materials and workmanship shall be of the respective kinds described in the specification, and the contractor shall upon the request of the architect furnish him with vouchers to prove that the materials are such as are specified.

Foreman.—8. The contractor shall keep constantly on the works a competent general foreman, and any directions or explanations given by the architect to such foreman shall be held to have been given to the contractor.

Dismissal of Workmen by Architect.—9. The contractor shall, on the request of the architect, immediately dismiss from the works any person employed thereon by him who may, in the opinion of the architect, be incompetent or misconduct himself, and such person shall not be again employed on the works without the permission of the architect.

Access for Architect to Works.—10. The architect and any person authorised by him shall at all reasonable times have access to the works, and the architect and his representatives shall at like times have access to the workshops of the contractor or other places where work is being prepared for the building.

Clerk of Works.—11. The clerk of works shall be considered to act solely as inspector and under the architect, and the contractor shall afford him every facility for examining the work and materials.

> The following clause was suggested in course of the architects' debate in place of the above:—
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> "The architect may be represented on the works by a clerk of works, or agent, who (if appointed) shall in the absence of the architect furnish the contractor with the architect's instructions and directions as to the progress and execution of the works, and the contractor shall duly attend to and comply with such instructions and directions, and shall upon the written requisition of the clerk of works stay the further progress of any portion of the works, which in his judgment is being constructed with unsound or improper materials, or workmanship, until the opinion and determination of the architect shall be obtained thereon;

but such clerk of works or agent is to have no power whatever to order any extra works, or deviation from the specification and drawings, and the contractors will have no claim for extra works ordered by him."

Variations and Extras.—12. The contractor shall not vary from the drawings or specification except as provided by Clause 5, or by the authority of the architect, which is to be sufficiently proved by any writing or drawing given by him or by any subsequent written approval by him. If the work shown on any of the details of the further drawings or details referred to in Clause 1, or necessary to comply with any instructions, directions, or explanations, which may be given from time to time by the architect, be, in the opinion of the contractor, in excess of that comprised in the contract, he shall, before proceeding with such work, give notice in writing to this effect to the architect. In the event of the architect and contractor failing to agree as to whether or not there is any excess, and of the architect deciding that the contractor is to carry out the said work, the contractor shall accordingly do so, and the question whether or not there is any excess, and if so the amount thereof, shall, failing agreement, be settled by the arbitrator as provided in Clause 32, and the contractor shall be paid accordingly. No claim for an extra shall be allowed unless it shall have been executed under the provisions of Clause 5, or by the authority of the architect as herein mentioned. Any such extra is hereinafter referred to as an authorised extra.

The clause "be in the opinion of the contractor in excess of that comprised in the contract, he shall, before proceeding with such work give notice," &c., has been strongly objected to, as imposing upon the contractor a task which is not seldom impossible without an expenditure of labour to which he should not be subject. No doubt the architect should know better than any one whether a detail is in excess of the contract or not, but such a clause has been used in recent conditions by many architects without objection on the part of the contractor, and it must be accepted as a necessary adjunct to the new arbitration clause (32).

Price for Extras; how ascertained.—13. No variation shall vitiate the contract; but all authorised extras for which a price may

not have been previously agreed, and any omission, which may have been made with the knowledge of the architect, or without his knowledge, provided he subsequently give a written sanction to such omission, shall be measured and valued, as hereinafter provided, by[1]

; and a copy of such measurement and valuation shall be given to the contractor. The fees for so measuring and valuing the variations shall be added to the contract sum. If in the opinion of the architect the work cannot be properly measured and valued, day work prices shall be allowed therefor, provided that vouchers specifying the time and materials employed shall have been delivered for verification to the architect, or his nominee, at or before the expiration of the week following that in which such work shall have been done. The variations shall be valued at the rates contained in the contractor's original estimate, or where the same may not apply, at rates proportionate to the prices therein contained. The amount to be allowed on either side in respect of the variations so ascertained shall be added to or deducted from the contract sum as the case may be.

Bills of Quantities; Expenses of.—14. The fees for the bills of quantities and the surveyor's expenses (if any) stated therein shall be paid by the contractor to the surveyor named therein out of and immediately after receiving the amount of the certificate or certificates in which they shall be included. The fees chargeable under Clause 13 shall be paid by the contractor before the issue by the architect of the certificate for the final payment. If the contractor fails or neglects to pay as herein provided, then the employer shall be at liberty, and is hereby authorised, to do so on the certificate of the architect, and the amount so paid by the employer shall be deducted from the amount otherwise due to the contractor.

NOTE.—In cases where the surveyor is engaged by the employer to be paid direct by him this clause will come out.

It has been objected to this clause that the expediency of introducing any question of bills of quantities or payment of the surveyor into a building contract is open to grave doubt, but it is the fact that many quantity-surveyors have

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[1] Insert "the architect," or "a surveyor appointed by the architect and approved by the contractor."

for years endeavoured to obtain the insertion of such a clause in any contract with which they have been connected.

Unfixed Materials when taken into account to be property of Employer.—15. When the contractor shall have received payment of any certificate in which the architect shall have stated that he has taken into account the value of any unfixed materials intended for the works, and placed by the contractor thereon, or upon ground adjacent thereto, all such materials shall become the property of the employer, and shall not be taken away, except for the purpose of being used on the building, without the written authority of the architect; and the contractor shall be liable for any loss of, or damage to, such materials.

Power to Architect to order removal of Improper Work.—16. The architect shall, during the progress of the works, have power to order in writing from time to time the removal from the works, within such reasonable time or times as may be specified in the order, of any materials which in the opinion of the architect are not in accordance with the specification or the instructions of the architect, the substitution of proper materials, and the removal and proper re-execution of any work executed with materials or workmanship not in accordance with the drawings and specification or instructions; and the contractor shall forthwith carry out such order at his own cost. In case of default on the part of the contractor to carry out such order, the employer shall have power to employ and pay other persons to carry out the same; and all expenses consequent thereon or incidental thereto shall be borne by the contractor, and shall be recoverable from him by the employer, or may be deducted by him from any moneys due or that may become due to him.

Defects after Completion.—17. Any defects, shrinkage, or other faults which may appear within months from the completion of the works, arising in the opinion of the architect from materials or workmanship not in accordance with the drawings and specification or the instructions of the architect, or any damage to pointing by frost appearing within the like period, shall upon the directions in writing of the architect, and within such reasonable time as shall be specified therein, be amended and made good by the contractor at his own cost, unless the architect shall decide that he ought to be paid for the same; and in case of default the employer may employ and pay other persons to

amend and make good such defects, shrinkage, or other faults or damage, and all expenses consequent thereon or incidental thereto shall be borne by the contractor, and shall be recoverable from him by the employer, or may be deducted by him from any moneys due or that may become due to the contractor. Should any defective work have been done or material supplied by any sub-contractor or other person employed on the works who has been nominated or approved by the architect, the contractor shall be liable to make good in the same manner as if such work or material had been done or supplied by the contractor, and been subject to the provisions of this and the preceding clause.

It will be seen that by these new conditions the idea of a final certificate (present in the old set) has been abandoned. The principle has been adopted that if the contractor has done anything objectionable and fraudulent, he shall be held liable until the Statute of Limitations releases him. In the conditions of the School Board for London there is, however, an express stipulation bearing upon this question. "No final or other certificate of payment or of completion, or payment, acceptance, or settlement of account, shall, under any circumstances, relieve the contractor from his liability for any fraud or wilful neglect, or default in the execution of the contract or any wilful or unauthorised deviations from the drawings, specification, and quantities, and instructions and directions for the time being binding upon him." It will be seen by the foregoing that in the School Board contracts the quantities are a part of the contract.

Work to be Opened up at Request of Architect.—18. The contractor shall, at the request of the architect, within such time as the architect shall name, open for inspection any work covered up; and should the contractor refuse or neglect to comply with such request, the architect may employ other workmen to open up the same. If the said work has been covered up in contravention of the architect's instructions, or if on being opened up it be found not in accordance with the drawings and specification or the instructions of the architect, the expenses of opening and covering it up again, whether done by the contractor or such other workmen, shall be borne by, and recoverable from, the contractor, or may be deducted as aforesaid. If the work has

not been covered up in contravention of such instructions, and be found in accordance with the said drawings and specification or instructions, then the expenses aforesaid shall be borne by the employer and be added to the contract sum: provided always that in the case of foundations, or of any other urgent work so opened up and requiring immediate attention, the architect shall, within a reasonable time after receipt of notice from the contractor that the work has been so opened, make or cause the inspection thereof to be made, and at the expiration of such time, if such inspection shall not have been made, the contractor may cover up the same, and shall not be required to open it up again for inspection except at the expense of the employer.

Assignment or Subletting.—19. The contractor shall not, without the written consent of the architect, assign this agreement or sublet any portion of the works.

> There was no prohibition of assignment in the former set of conditions; this condition removes a grave defect.

Sub-contractors.—20. No sub-contractor or other person nominated by the architect shall be employed upon the works against whom the contractor shall make what the architect considers reasonable objection, or who will not enter into a contract with the contractor guaranteeing the due performance of his work, and indemnifying the contractor against any claims arising out of misuse by the sub-contractor or his workmen of any scaffold erected or plant employed by the contractor, or that may be made against the contractor in consequence of any act, omission, or default of the sub-contractor, his servants or agents.

Damage to Person and Property.—21. The contractor shall be responsible for all structural and decorative damage to property, and for injury caused by the works or workmen to persons, animals, or things, and shall hold the employer harmless in respect thereof. He shall also be responsible for all injuries caused to the buildings, the subject of this contract, by frost, or other inclemency of weather, and shall reinstate all damage caused by the same, and thoroughly complete the whole of the works.

Insurance.—22. (*a*) The contractor shall insure the works, and keep them insured until they are delivered up, against loss or

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(*a*) Of a new building.

damage by fire, in an office to be approved by the architect, in the joint names of the employer and contractor, for the full value of the works executed, and shall deposit with the architect the policies and receipts for the premiums paid for such insurance; and in default the employer may insure the works and deduct the premium paid from any moneys due or which may become due. All moneys received under any such policies are to be paid to the contractor by instalments on the certificates of the architects, and to be applied in or towards the rebuilding or reparation of the works destroyed or injured. The contractor shall, as soon as the claim under the policy is settled, proceed with all due diligence with the rebuilding or reparation, and shall not be entitled to any payment in respect thereof other than the said moneys received, but such extension of the time hereinafter mentioned for completion shall be made as shall be just and reasonable. (*b*) The whole building and the works executed under this contract shall be at the sole risk of the employer as regards any loss or damage by fire, and in the event of any such loss or damage being so occasioned which affects the original building or structure in addition to the new work, the contractor shall be entitled to receive from the employer the full value of all work then executed and materials then delivered, calculated in the manner provided for by Clause 13 hereof, and this contract, so far as it relates to any subsequent work, may at the option of either party be determined if in the opinion of the arbitrator such determination shall be just and equitable.

NOTE.—Clause (*a*) or (*b*) to be struck out to suit circumstances.

Date of Completion.—23. Possession of the site (or premises) shall be given to the contractor on or before the day of . He shall begin the works immediately after such possession, shall regularly proceed with them, and shall complete the same (except painting and papering or other decorative work which in the opinion of the architect it may be desirable to delay) by the day of , subject nevertheless to the provisions for extension of time hereinafter contained.

(*b*) Of a building in course of alteration.

Penalties for Non-Completion.—24. If the contractor fail to complete the works by the date named in Clause 23, or within any extended time allowed by the architect under these presents, and the architect shall certify in writing that the works could reasonably have been completed by the said date, or within the said extended time, the contractor shall pay or allow to the employer the sum of £ sterling per[1] as liquidated and ascertained damages for every[1] beyond the said date or extended time, as the case may be, during which the works shall remain unfinished, except as provided by Clause 23, and such damages may be deducted by the employer from any moneys due to the contractor.

Extension of Time.—25. If in the opinion of the architect the works be delayed by *force majeure* or by reason of any exceptionally inclement weather, or by reason of instructions from the architect in consequence of proceedings taken or threatened by or disputes with adjoining or neighbouring owners, or by the works or delay of other contractors or tradesmen engaged or nominated by the employer or the architect, and not referred to in the specification, or by reason of authorised extras or additions, or in consequence of any notice reasonably given by the contractor in pursuance of Clause 12, or by reason of any local combination of workmen or strikes or lock-out affecting any of the building trades, or in consequence of the contractor not having received in due time necessary instructions from the architect for which he shall have specifically applied in writing, the architect shall make a fair and reasonable extension of time for completion in respect thereof. In case of such strike or lock-out the contractor shall, as soon as may be, give to the architect written notice thereof. But the contractor shall nevertheless use his best endeavours to prevent delay, and shall do all that may reasonably be required to the satisfaction of the architect to proceed with the works.

Suspension of Works by Contractor.—26. If the contractor, except on account of any legal restraint upon the employer preventing the continuance of the works, or on account of any of the causes mentioned in Clause 25, or in case of a certificate being withheld or not paid when due, shall suspend the works, or in the opinion of the architect shall neglect or fail to proceed with

[1] Insert "day" or "week" as may be agreed.

due diligence in the performance of his part of the contract, or if he shall more than once make default in the respects mentioned in Clause 16, the employer by the architect shall have power to give notice in writing to the contractor requiring that the works be proceeded with in a reasonable manner and with reasonable dispatch. Such notice shall not be unreasonably or vexatiously given, and must signify that it purports to be a notice under the provisions of this clause, and must specify the act or default on the part of the contractor upon which it is based. After such notice shall have been given, the contractor shall not be at liberty to remove from the site or works, or from any ground contiguous thereto, any plant or materials belonging to him which shall have been placed thereon for the purposes of the works; and the employer shall have a lien upon all such plant and materials, to subsist from the date of such notice being given until the notice shall have been complied with. Provided always that such lien shall not under any circumstances subsist after the expiration of thirty-one days from the date of such notice being given unless the employer shall have entered upon and taken possession of the works and site as hereinafter provided. If the contractor shall fail for   days after such notice has been given to proceed with the works as therein prescribed, the employer may enter upon and take possession of the works and site, and of all such plant and materials thereon (or on any ground contiguous thereto) intended to be used for the works, and all such materials as above mentioned shall thereupon become the property of the employer absolutely, and the employer shall retain and hold a lien upon all such plant until the works shall have been completed under the powers hereinafter conferred upon him. If the employer shall exercise the above power he may engage any other person to complete the works, and exclude the contractor, his agents and servants, from entry upon or access to the same, except that the contractor or any one person nominated by him may have access at all reasonable times to inspect, survey, and measure the works. And the employer shall take such steps as in the opinion of the architect may be reasonably necessary for completing the works without undue delay or expense, using for that purpose the plant and materials above mentioned in so far as they are suitable and adapted to such use. Upon the completion of the works the architect shall certify the amount of the expenses properly incurred consequent on and incidental to the default of the contractor

as aforesaid, and in completing the works by other persons. Should the amount so certified as the expenses properly incurred be less than the amount which would have been due to the contractor upon the completion of the works by him, the difference shall be paid to the contractor by the employer; should the amount of the former exceed the latter, the difference shall be paid by the contractor to the employer. The employer shall not be liable to make any further payment or compensation to the contractor for or on account of the proper use of the plant for the completion of the works under the provisions hereinbefore contained other than such payment as is included in the contract price. After the works shall have been so completed by persons other than the contractor under the provisions hereinbefore contained, the employer shall give notice to the contractor of such completion, and may require him from time to time, before and after such completion, to remove his plant and all such materials as aforesaid as may not have been used in the completion of the works from the site. If such plant and materials are not removed within a reasonable time after notice shall have been given, the employer may remove and sell the same, holding the proceeds, less the cost of the removal and sale, to the credit of the contractor. Any notice to be given to the contractor under this clause shall be given by leaving the same at the place of business of the contractor, or by registered letter sent to him at that address.

Prime Cost, Meaning of.—27. The words "prime cost" or the initials P. C. applied in the specification to goods to be obtained and fixed by the contractor, shall mean, unless otherwise stated in the specification, the sum paid to the merchant after deducting all trade discount for such goods in the ordinary course of delivery, but not deducting discount for cash, and such sum shall be exclusive of special carriage, the cost of fixing, and contractor's profit.

Provisional Sums.—28. The provisional sums mentioned in the specification for materials to be supplied or for work to be performed by special artists or tradesmen, or for other works or fittings to the building, shall be paid and expended at such times and in such amounts and to and in favour of such persons as the architect shall direct, and sums so expended shall be payable by the contractor without discount or deduction, or (without prejudice to any rights of the contractor existing under

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the contract referred to in clause No. 20) by the employer to the said artists or tradesmen. The value of works which are executed by the contractor in respect of provisional sums, or in additional works, shall be ascertained as provided by Clause 13. At the settlement of the accounts the amount paid by the contractor to the said artists or tradesmen, and the said value of such works executed by the contractor, shall be set against all such provisional sums or any sum provided for additional works, and the balance shall be added to or deducted from the contract sum.

Contractor to erect Scaffolding for Sub-contractors.—29. The contractor shall, unless otherwise stated in the specification, provide and erect all necessary scaffolding and plant for the due execution by the artists and tradesmen referred to in the preceding clause of the work entrusted to them. He shall also permit of the execution of work by any other artists or tradesmen who may be engaged by the employer.

Payment and Certificates.—30. The contractor shall be entitled under the certificates to be issued by the architect to the contractor, and within days of the date of each certificate, to payment by the employer from time to time by instalments, when in the opinion of the architect work to the value of £ (or less at the reasonable discretion of the architect) has been executed in accordance with the contract, at the rate per cent. of the value of work so executed in the building, until the balance retained in hand amounts to £ , after which time the instalments shall be up to the full value of the work subsequently executed. The contractor shall be entitled, under the certificate to be issued by the architect, to receive £ , part of the said sum of £ , when the works are practically completed, and in like manner to payment of the balance within a further period of months, or as soon after the expiration of such period of months as the works shall have been finally completed, and all defects made good according to the true intent and meaning hereof, whichever shall last happen. The architect shall issue his certificates in accordance with this clause. No certificate of the architect shall be considered conclusive evidence as to the sufficiency of any work or materials to which it relates, nor shall it relieve the contractor from his liability to make good all defects as provided by this agreement. The contractor when applying for a certificate

shall, if required, as far as practicable, furnish to the architect an approximate statement of the work executed, based on the original estimate.

> There is probably no course so effectual to the rectification of defective work as the withholding of a certificate, and the absence of a specific clause affecting this question has been debated.
>
> The following is sometimes used:
>
> "The architect shall be entitled to withhold any certificate in respect of work not carried out to his satisfaction or while the contractors fail to comply with his instructions or make needless delay in proceeding with the works." It is submitted that the Clause 30 confers as much power as can be legally exercised.

Non-payment by Employer.—31. Should the employer not pay the contractor any sum certified by the architect within the times respectively named in Clause 30, the contractor shall give written notice to the employer of the non-payment, and should the employer not pay any such sum within the period of days from the date of delivery of such notice at the employer's address or sent to him there in the ordinary course of post by registered letter, or if the employer shall become bankrupt or file any petition for liquidation of his affairs, and if his trustee in bankruptcy shall repudiate this contract, or if the trustee shall be unable to show within days to the reasonable satisfaction of the contractor his ability to carry out the contract, and to make all payments due or to become due thereunder, or if the works be stopped for months under an order of the architect or any court of law, the contractor shall be at liberty to determine the contract by notice in writing to the architect, and to recover from the employer payment for all work executed and for any loss he may sustain upon any plant or material supplied or purchased or prepared for the purpose of the contract. In arriving at the amount of such payment the rates contained in the contractor's original estimate shall be followed, or, where the same may not apply, rates proportionate to the prices therein contained.

Arbitration.—32. Provided always that in case any dispute or difference shall arise between the employer or the architect on

his behalf and the contractor, either during the progress of the works or after the determination, abandonment, or breach of the contract, as to the construction of the contract or as to any matter or thing arising thereunder (except as to the matters left to the sole discretion of the architect under Clauses 4, 9, and 19, and the exercise by him under Clause 18 of the right to have any work opened up), or as to the withholding by the architect of any certificate to which the contractors may claim to be entitled, then either party shall forthwith give to the other notice of such dispute or difference, and such dispute or difference shall be and is hereby referred to the arbitration and final decision of

or, in the event of his death or unwillingness or inability to act, of

, or in the event of his death or unwillingness or inability to act, of a person to be appointed on the request of either party by the President for the time being of the Royal Institute of British Architects, and the award of such arbitrator shall be final and binding on the parties. Such reference, except on the question of certificate, shall not be opened until after the completion or alleged completion of the works, unless with the written consent of the employer or architect and the contractor. The arbitrator shall have power to open up, review, and revise any certificate, opinion, decision, requisition, or notice, save in regard to the said matters expressly excepted above, and to determine all matters in dispute which shall be submitted to him, and of which notice shall have been given as aforesaid, in the same manner as if no such certificate, opinion, decision, requisition, or notice had been given. Upon every or any such reference the costs of and incidental to the reference and award respectively shall be in the discretion of the arbitrator, who may determine the amount thereof, or direct the same to be taxed as between solicitor and client or as between party and party, and shall direct by whom and to whom and in what manner the same shall be borne and paid. This submission shall be deemed to be a submission to arbitration within the meaning of the Arbitration Act, 1889.

A comparison of this clause with that propounded by the Institute of Builders will show the points of difference.

Clause 32 provides that arbitration shall be deferred until the completion of the works, the Builders' clause that it shall be available at any stage of their progress. While admitting that it may be necessary, under some circumstances, that an arbitration should be held during the progress of the work which, despite Clause 32, would be possible by mutual agreement, it is nevertheless beyond question that Clause 32, as it now stands is by far the better clause of the two, and the justice of the opinions expressed by Mr. Strahan in his paper, "The Legal Position of Architects in Relation to Certificates and Awards," read before the architects 28th January, 1895, must commend themselves to the judgment of the majority of employers and their architects. Referring to the power of the builder to induce arbitration, he says:—

"In the first place, he can harass the employer by opening up everything arising or done under the contract, and by making all sorts of allegations as to the conduct of the architect and the employer himself. By insisting on having all these investigated he can give great trouble and cause enormous expense. Very often the mere threat of doing so is sufficient to induce the employer to come to an arrangement all to the advantage of the contractor.

"In such contracts I usually advise that a clause be inserted making the architect's decision on all disputes and matters arising during the progress of the works final and conclusive, until the completion of the works. This is necessary to prevent delay, through the reference of disputes to arbitration during the progress of the works—delay which is sure to give rise to further disputes as to penalties, time of completion, and other matters.

"Clause 32 may be said to affirm the principle that the building shall be erected under the architect's sole direction, and not under the direction of the arbitrator; and that with regard to all questions of materials and the manner of execution the architect's power, until the completion of the building, shall be absolute."

When an arbitrator has been called in during the progress of the work the question is sure to be raised whether the architect's control was or was not superseded by that of the arbitrator.

I have to acknowledge my obligation to the members of the Royal Institute of British Architects, who took part in the debates upon these conditions, whose ideas and phraseology I have in some cases adopted, and also to the council for permission to print them. I gladly comply with the stipulations which follow:—

The Council allow you to print the Agreement in the Appendix to your manual on *Specifications*, provided that you state therein to the following effect:—

1. That the said Form of Agreement and Schedule of Conditions for Building Contracts is the exclusive property of the Royal Institute of British Architects.

2. That it supersedes a form of "Heads of Conditions of Builders' Contracts" originally agreed to with the Builders' Society, which form was withdrawn from circulation by the Institute on the 13th May last, when the sanction of the general body to its further issue was also withdrawn—notice of the same having been sent, at the same time, to the Institute of Builders, which Institute had been in the habit of publishing and selling such form, or one with similar conditions.

3. That permission to print, in the above-mentioned work, the new Form of Agreement and Schedule of Conditions for Building Contracts, for which application was made, has been granted by resolution of the Council of the Royal Institute of British Architects, 4th November, 1895.

SECTION V:

CLAUSES WHICH APPLY TO WORKS OF A SPECIAL CHARACTER.

SEWERS.

In addition to the ordinary items of contract (from which a selection may be made) there are certain special ones which will be required, such as the following:—

Quality of Materials. The whole of the materials supplied in carrying out the works mentioned in this specification shall be the best of their several kinds, and to the approval of the engineer. Any material that may be disapproved shall be kept on the works until their completion.

Time. The work to be commenced within seven days from the receipt of a written notice from the clerk to the board or the engineer, and shall be completed and handed over to the local board within six months after the date of such notice, and in case of default the contractor shall pay the local board the sum of ten pounds for every week or part of a week, as liquidated and agreed damages, as long as the work shall remain unfinished.

Each section of the works shall be commenced at such times, and only such lengths of trench shall be opened as the engineer shall direct, and the execution of the work shall proceed at such speed as he shall direct.

Payments. Payments will be made to the contractor on the certificate of the engineer, at the rate of 80 per cent. upon the value of the work executed and of the materials on the works, the first payment to be made when the engineer shall consider that 10 per cent. of the work contracted for has been done, and subsequent payments in similar proportion, an additional 5 per cent. three months after certificate of completion, and the remainder six months after completion.

Protection of Work. Protect the whole of the works included in this contract, and make good or pay compensation for any accident or damage to persons or property, and all claims for anything that may be stolen, removed, or destroyed. Make good all sewers, drains, gaspipes, waterpipes, or other property broken or damaged by the contractor's servants, agents, or workmen, by or in consequence of their operations or in consequence of trespass committed by them, and whether such damage or defects may be or might have been discovered during the progress of the works, or whether payment may have been wholly or partially made, or the works approved as having been properly done, and in case of any action or suit at law or other proceedings being brought or taken against the local board or any of their officers or servants in respect of any such damage or defects, or any loss, damage, or injury by reason thereof or consequent therefrom, to fully indemnify the local board therefrom, and forthwith pay to them such sum as may be required.

Take up Work. Take up or undo any portion of the work executed if the engineer should so order, for the purpose of ascertaining whether or not such work has been done according to the terms of the specification.

Sinking of Work. Should the paving or roadway over the line of sewer sink within three months after the completion of the contract the contractor shall take up such part and relay it at his own expense.

Foreman. The contractor shall keep a competent and approved foreman constantly on the works, and he shall not be changed without the engineer's permission.

Water. The contractor will be allowed to take water for the works from the vestry's nearest water-post, but he shall convey it to the works and supply any requisite storage.

Earth, &c. not to be placed on footway. No earth, rubbish, or materials shall be deposited upon any footway or crossing under penalty of £5 for each offence.

Samples. The contractor shall send in with his tender samples of each of the various kinds of bricks specified to be used on the works.

The contractor shall deliver, when called upon, at the yard of the local board, for approval by the engineer, samples of the various kinds of bricks, cement, gravel, sand, drain pipes, and granite cubes intended to be used on the works,

and all articles and materials used shall agree in every respect with the approved samples.

Notices. Give notice to any persons requiring notice, and pay all fees.

Setting Out. Set out the works and supply all rods, tapes, stakes, poles, labour, and other matters in setting out the works, and also such as may be required by the engineer or his assistant to check the setting out.

Clerk of Works. The work will be carried out under the supervision of a clerk of works. Supply and fit up an improved movable office, 10 ft. by 8 ft., for his accommodation, with all requisite fittings, stove, firing, lighting, and attendance. Maintain during the progress of the works, and remove when and as often as may be required to such positions as may be directed, and remove at completion.

Damage. The contractor shall use great care to damage as little as possible the watercourses, hedges, fences, &c., which it may be necessary to break through or disturb to allow of the construction of the works. Make good at completion, and leave in as good order as before disturbance. Make adequate provision in place of watercourses where broken through during the progress of the works, and avoid any obstruction of the flow of the water.

Protect or Sling Pipes, &c. Preserve intact, properly sling, hold in position, raise or lower where necessary all gas, water, or other pipes, with their plugs, boxes, or other appurtenances, that may be met with in the doing of the works, and make good, reinstate, and leave perfect at completion.

Facilities and Tools for Engineer. Afford the engineer or his representative every facility, and such tools and labour as he may require, to examine and test the materials and work.

Fences and Lights. Supply, fix, and maintain during the progress of the works such substantial and proper fences as may be necessary for guarding and protecting them from injury, and the public from accident, also a sufficient number of lights to properly light the works, and fencing and a watchman wherever a trench remains open during the night.

Footways and Rails. Supply wherever necessary proper planked footways, with substantial posts and handrails, all to the engineer's satisfaction.

Connect Branch Drains with Sewers. Connect any new sewers or house drains with the new sewers during the progress of the works, if the local board or their engineer should require it, and do all work necessary to complete them.

Remove Rubbish, &c. Remove from the works with all convenient speed all surplus ground rubbish, materials, or other matters taken out of the trenches or elsewhere, and not required for use on the works.

Measuring Boxes. Supply boxes to be used for measuring the materials for mortar or concrete, and wooden planking on which both shall be mixed.

Baling and Pumping. Keep foundations free of water from whatever source, and do all baling or pumping required.

Levels of Invert. The red line on the section No. 4 indicates in all cases the bottom of the invert.

Excavator.

Digging Trenches. Dig for the trenches manholes, lampholes, &c., as required.

Deposit of Earth. The materials excavated shall be laid as compactly as possible and neatly trimmed up. A space shall be left on each side of the trench of a width of not less than 2 ft. as passage.

Men to keep near to Trenches. In digging the trench through the fields and gardens the contractor and his men shall keep within 25 ft. on either side of the trench.

Open Cutting. The trenches for all sewers and drains shall be excavated in open cutting the full width of the trenches.

Remove Ground under Sockets of Pipes. Take out the ground under each socket of the pipe drain so that no part of the socket shall touch the bottom of the trench, but each pipe shall have a firm and even bearing on the ground for its entire length. Should the soil be gravel, the hole for the socket shall be filled with well puddled plastic clay.

Fill up Irregularities in Trenches. Fill in all irregularities in the bottoms of the trenches resulting from bad workmanship or otherwise with cement concrete or gravel thoroughly rammed as the engineer may direct, and where the bottom is soft excavate as directed, and fill in as last described.

Preserve Surface Materials. When digging trenches carefully take up, lay aside, and

preserve for reinstatement all turf, soil, granite, gravel and other surface material.

Filling in of Trenches. On completion of each length of the work, and after it has been approved, the trenches shall be carefully filled in for a thickness of 6 in. above the brickwork of the sewer or the pipes with the finest material excavated, and the remaining portion in layers not exceeding 6 in. in thickness extending the whole length to be filled in and rammed with iron rammers. For every man filling in, two men shall be employed to ram, and so on in proportion for any number filling in.

Watering of Trenches. The trenches shall be watered if the engineer shall consider it necessary.

Keep filling above Adjacent Levels. The surface of the trenches in the fields when finished shall be left at a level of 6 in. above the adjoining land.

Materials of filling in of Trenches. In filling trenches on the highway no clay shall be placed nearer than 15 in. below the surface, but that portion of the trench shall be filled in as follows: 9 in. of hard core as described, 3 in. of thoroughly screened ballast, and 3 in. of broken granite similar to that forming the surface of the adjoining roadway. The surface materials may be preserved for re-use and screened, and so much of them as may be considered by the engineer to be suitable may be used for the repair of the parts of the road which have been broken up; but should the quantity of screened materials be insufficient to make good the surface and reinstate it in as good condition as before disturbance, the contractor shall supply and lay on at his own cost the required quantity of new materials so as to assimilate it with the adjoining surface, whether such surface be macadamized or otherwise.

Drains, &c., to be left Watertight. All drains, sewers, and manholes shall be left perfectly watertight at completion.

Strutting and Planking. Supply all requisite strutting and planking, centering and moulds.

Sand. The sand to be clean and sharp, free from all loam and clay, and well washed before use.

Gravel. The gravel to be clean, and perfectly free from loam or clay.

Hard Core. The hard core shall be hard-burnt clinkers, broken brick

or stone, or other approved hard material. No rags or tins or any perishable material shall be used.

Cement. The cement to be Portland, of the best quality, from an approved manufacturer, to weigh not less than 114 lbs. per striked imperial bushel when poured lightly in, to be slow-setting, uniform in quality, grey in colour, of such fineness that at least 95 per cent. will pass through a sieve of 2,500 meshes to the square inch, and when gauged pure in the proportion of 9 ozs. of water to 40 ozs. of cement, and on the following day placed in water, and allowed to set for seven days under water it shall withstand a tensile strain of at least 40 lbs. per square inch.

The cement to be delivered perfectly fresh on the works in such quantities only as from time to time may be directed by the engineer, and to be taken out of the casks or bags, and turned over on a dry boarded floor under cover at least three times.

Mortar. The mortar shall be gauged in the proportions of 1 part of cement to 2 parts of sand, and no mortar that has once set shall be reused.

Concrete. The concrete shall be composed of 1 part of Portland cement, 5 parts of gravel stone or broken stone, and 1 part of sand, the whole thoroughly mixed together on boards before any water is added.

Stock Bricks. The stock bricks shall be sound, hard, well burnt, truly shaped ringing stocks, free from all defects.

Gault Bricks. The gault bricks shall be wire-cut seconds, hard, well burnt, truly shaped, and even in thickness, and truly radiating arch bricks.

Staffordshire Bricks. The blue bricks to be the best Staffordshire facing bricks, thoroughly vitrified through their whole substance, so as to show no trace of redness when broken.

Bond of Brickwork. The brickwork wherever possible shall be laid Old English bond, all bed and cross joints completely filled with mortar, and no joint shall exceed $\frac{1}{4}$ in. in thickness; all the joints to be neatly struck as the work proceeds.

Drain Pipes. The drain pipes shall be the best town made, glazed stoneware, socketed pipes, perfectly cylindrical, straight, free from blisters, flaws, cracks, and other defects, and shall be of the dimensions and thicknesses as follows :—

Diameter. Inches.	Thickness. Inches.	Length in Work. Feet.	Depth of Socket. Inches.
4	$\frac{1}{2}$	2	$1\frac{3}{4}$
6	$\frac{5}{8}$	2	$1\frac{3}{4}$
9	$\frac{3}{4}$	2 or $2\frac{1}{2}$	$2\frac{1}{4}$
12	1	2 or $2\frac{1}{2}$	$2\frac{1}{2}$
15	$1\frac{1}{4}$	2 or $2\frac{1}{2}$	$2\frac{3}{4}$
18	$1\frac{1}{2}$	2 or $2\frac{1}{2}$	$2\frac{3}{4}$

Ironwork. The ironwork shall match in pattern, quality, and weight, the similar articles at present used by the local board. Samples may be seen at their office. They shall be similar in construction to those sold by George Waller & Co., Park Street, Southwark, numbers in whose catalogue are hereafter mentioned.

Yorkshire Stone. The stone shall be Yorkshire stone of the hardest blue quality, finely tooled on faces and edges.

Granite Setts. The granite cubes shall be Mountsorrel, accurately and neatly dressed.

Pipe Drains. Lay the pipe drains of the sizes figured or shown on the drawings, and supply all requisite bends, junctions, diminishing pieces, &c.

Jointing of Pipe Drains. All joints shall be made with one strand of tarred yarn and neat cement. The cement shall thoroughly fill the space between the spigot and the socket, and shall be finished smooth on the outside of the joint. No part of the cement joint shall be made in water.

Leave Pipe Drains Clean. No cement shall be left inside the pipes, and every pipe shall be cleaned out before the next one is laid. If on examining the work at completion any cement or other material is found in the pipes, or that irregularities of any kind exist, the pipes shall be taken up and relaid in a proper manner by the contractor at his own cost.

Eyelets. Where pipe drains run into brick sewers they shall have eyelets formed in two half brick rings.

Lampholes. Form lampholes in the line of pipes with a specially made junction with 9 in. outlet, and bed it in cement concrete the whole length of junction and 12 in. wider than the external diameter of the pipes. Carry up from the junction to the surface of the road an upright shaft of 9 in. pipes to match the drain embedded in cement concrete 2 ft. by 2 ft.

Supply for each a cast-iron lamphole cover and galvanized dirt box 12 in. diameter with round base (Wallers' 69 B), and form around it a ring of blue Staffordshire bricks 2 ft. 6 in. external diameter on end on 6 in. of cement concrete.

Brick Sewer. Build the brick sewers of gault bricks of egg-shaped section (Fig. 27); carefully observe the gradients indicated on the sections.

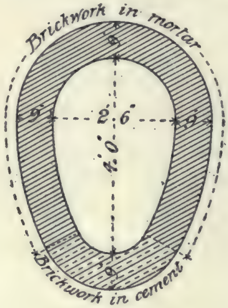


FIG. 27.

Lampholes. Form lampholes where shown, constructed as follows:—

Lay on the back of brick sewer, so as to stop the arch, a slab of 4 in. York stone with rebated perforations 12 in. diameter, bed on this in cement, a 12 in. stoneware taper piece, form shaft from thence to surface of the ground with 9 in. drain pipe jointed in cement and embedded in cement concrete 2 ft. by 2 ft.

Supply for each shaft a cast-iron lamphole cover 12 in. diameter with round base, and galvanized dirt box (Wallers' 69 B), and form around it a ring 42 in. diameter of four rings of 4 in. by 4 in. granite cubes grouted in cement and bedded in concrete 6 in. thick.

Manholes. Build the manholes of gault bricks 9 in. thick with two courses of footings on concrete 12 in. thick, the whole size of the excavation.

Supply a cast-iron cover and frame 22 in. diameter with square base and dirt pan (Wallers' 69 B), and bed on the brickwork.

Turn over a part of each manhole an arch in two half-brick rings as shown.

Penstocks. Fix in five of the manholes a galvanized cast-iron sluice frame or penstock with gear balance weights, adjustable wedges, top box and guide, and brass faces (Wallers' No. 5), 4 ft. 2 in. by 2 ft. 11 in., fixed with bolts to the brickwork, and the brickwork neatly cut and fitted to the frame.

Foot Irons. Supply and fix in two alternate corners of each manhole, about 12 in. apart, wrought foot irons of $1\frac{1}{2}$ in. by $\frac{1}{2}$ in. metal and 15 in. long.

Painting. Paint the whole of the ironwork not described to be galvanized two coats before fixing in Torbay paint, and two coats after fixing in ordinary oil colour.

CHURCH SHORING.—*See Notes, p.* 539.

In addition to the ordinary items of contract there are certain special ones or variations of those before mentioned which may be required, such as the following:—

Specification of works to be done in shoring, and underpinning parts of the chancel and northern arcade of the nave of Church.

HENRY JAMES,
Architect,
36, Wood Street,
November, 1899. London.

The preliminary item as to disposal of bodies and earth in the section "Church Restoration" (see *post*) may be used here.

Materials. Describe the whole of the materials here in all trades.

All Work in Cement. The whole of the new work and making good shall be built in cement.

New Work to Match Old. The new stone and the detail of the new stonework to match the old.

Centering. The centering, shoring, and needling shall be done to detail drawings; shall be of sound fir, sawn die square, tenoned, mortised, and framed together in the best manner, and secured by dogs, straps, bolts, and hoop-iron. The easing and striking of the centering shall be done only while the architect or clerk of works is present.

Wedging up Timber and Cutting Old Work. Care to be observed in the wedging up of the centering and shores, the cutting holes for needles, and the removal of old stonework to disturb the structure as little as possible; and the attention of the architect shall be called to any new crack, movement, or settlement in the old walls which may appear during the progress of this scheme of repair.

Work to be Done. The work consists of the underpinning of the eastern and

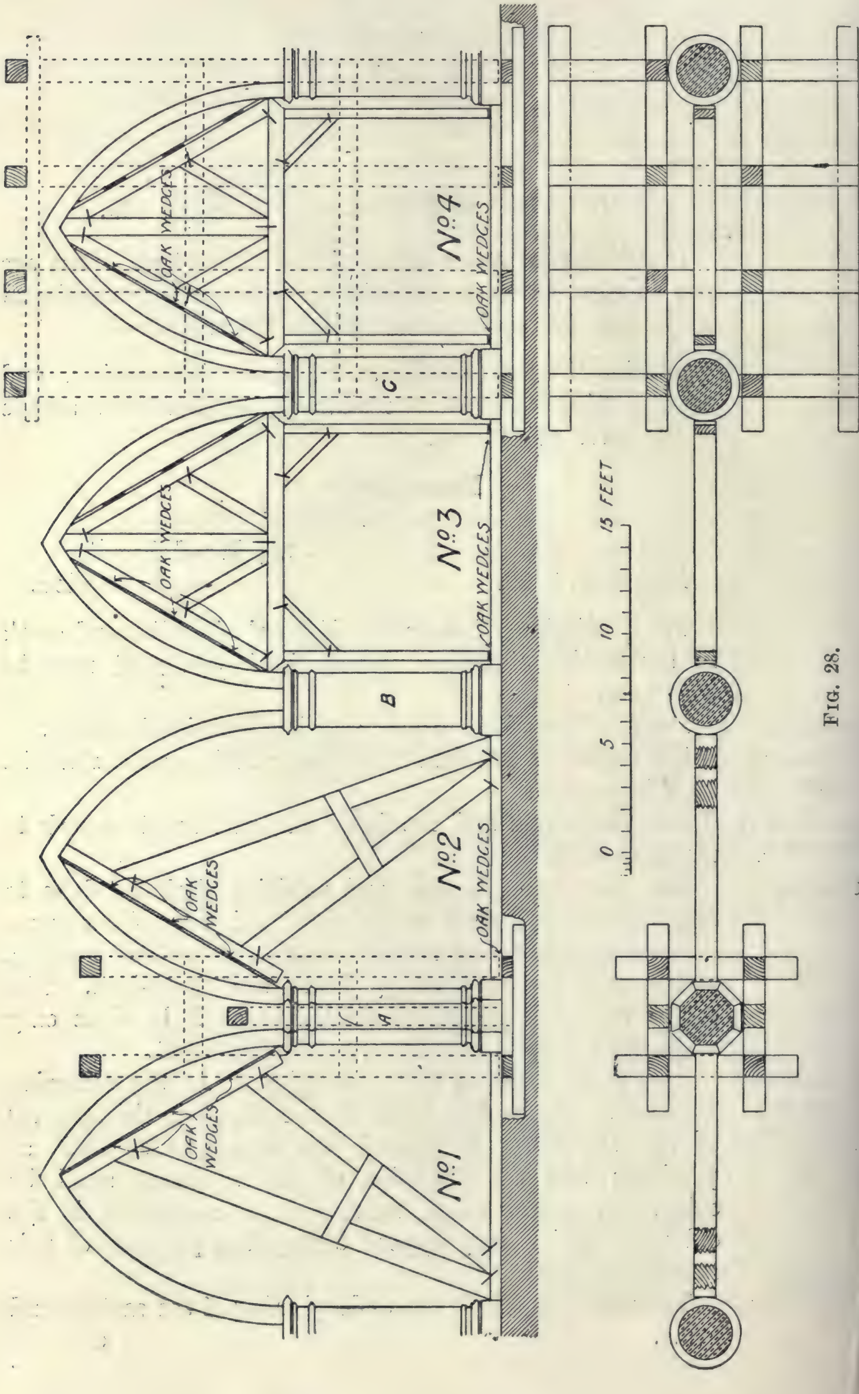

No. 1
OAK WEDGES
A
No. 2
OAK WEDGES
OAK WEDGES
B
No. 3
OAK WEDGES
OAK WEDGES
C
No. 4
OAK WEDGES
OAK WEDGES
0
5
10
15 FEET

FIG. 28.

western responds, the entire removal of the column A, the removal of the arch No. 4, and removal and reinstatement of decayed stones in various parts of the building.

Order of doing the Work. The architect will direct the order which shall be adopted in the doing of the work. The probable order is as follows, but it shall be changed if the architect should so decide:—

1st. The underpinning of the responds.
2nd. The reinstatement of pier A.
3rd. The reinstatement of arch 4.

Underpinning of Eastern and Western Responds. Construct a centre to design, accurately fitted to the chancel arch, strutted and wedged up from a sole piece laid on the middle step of the chancel, and also wedged up from a horizontal beam just below the level of the springing of the arch.

Shore up the wall over the respond on both sides with two 12 in. by 9 in. raking shores on each side, as Fig. 29.

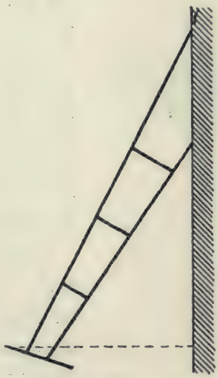


FIG. 29.

Shore up the south-west and north-west angles of the western wall of the chancel, and the western wall of north aisle from the outside as shall be directed, also shore up the eastern end of north wall of nave on both sides.

Carefully remove in small quantities the foundation of the eastern respond. Excavate the earth beneath it down to the gravel about 7 ft. below the nave floor. Fill in with cement concrete as described, well beaten and rammed, and of the depth shown on drawing. Lay thereon the whole size of the concrete 6 in. finely tooled York landing of hardest York in one stone; on this build with four steps of footings, two courses in each step, a pier of hardest blue Staffordshire bricks in cement, the whole size of the present pier of the respond and chancel arch, and continued for a length of 18 in. beneath the northern wall of the chancel and the eastern wall of north aisle respectively, this work to be carried up to the level of the floor in each case.

Wedge up between the new and old work with iron

Underpinning of Eastern and Western Responds.

wedges and stoutest slates in cement, and pour in cement grout of equal parts of cement and washed sand.

Shore up the main western wall of nave, inside and out, and of north aisle and western end of arcade wall, as shall be directed, and underpin western respond as last described.

Lay between the piers of nave arcade in archways marked 1 and 2 on drawing, a sole piece of oak 12 in. by 6 in. Shore up from this sole piece as shown with two 12 in. by 12 in. shores tenoned into a turning piece 12 in. thick and of the depth shown, in two pieces, the upper edge of the upper piece accurately shaped to the soffit of the existing arch, and carefully wedged with oak wedges between the upper and lower piece. Tie each pair of shores together with a 9 in. by 4 in. tie on each side.

Insert two 12 in. by 12 in. needles in wall over pier A supported by four 12 in. by 12 in. posts wedged up from 12 in. by 6 in. sole pieces laid across 4 bearers of similar section, and both sole pieces and bearers 8 ft. 6 in. long.

Removal of Pier A of Nave Arcade.

Remove the pier and springer of nave arcade marked A on the drawing and its foundation. Dig for the new foundation down to the bed of gravel before described. Build new foundation as shown on drawing of York stone, Staffordshire bricks, and cement concrete as described for foundations of responds.

Build in approved Ketton stone the pier above floor level, and supply new springer. The base of pier, the drums of shaft, the cap and springer, each to be in single stones, to course with the old piers, and bedded and jointed in cement. Lay in each bed of shaft a plate of 4 lbs. lead, 1 in. less in diameter than the shaft. Carefully rake out the joints, and point with mason's putty.

Removal of Arch of Nave Arcade.

Lay between the piers of archways marked 3 and 4 on drawing 12 in. by 6 in. oak sole piece. Strut up from this sole piece with two 12 in. by 6 in. posts wedged at bottom.

Supply a centre for each arch of tie beam 12 in. by 9 in., post 12 in. by 9 in., ribs 12 in. thick, in two pieces, the upper accurately cut to contour of arch, and wedged with oak wedges. Struts 6 in. by 9 in., all framed together, struts below tie beam 4 in. by 4 in.

Needle the clerestory wall over arch 4 with 12 in. by 12 in. needles, strutted up from floor by 12 in. by 12 in.

posts on each side of wall. Supply 12 in. by 6 in. sole pieces laid on 12 in. by 6 in. bearers as sketch. Supply two waling pieces bolted to the system of posts on each side of wall.

Carefully take out No. 4 arch (except the springers) and the wall below the needles down to caps of columns. Replace the stonework of arch and rebuild the wall, using the sound old stones and supplying new in place of the remainder, all set in cement, raked out, and pointed as before.

Remove Paving and Seats. Remove the paving and seats which may interfere with access to the foundations, deposit where directed, cover and protect and refix, carefully repairing and reinstating any parts damaged by removal.

Fill up Holes. Fill up the holes cut for this work with stone to match the old, clean down the whole of the new work, and leave perfect.

CAMP-SHEDDING, COFFERDAMS, &c.—*See Notes, p.* 411.

In addition to the ordinary items of a contract there are certain special ones or variations of those before mentioned which may be required, such as the following:—

Cofferdams for piers have been superseded by iron cylinders bolted together and sunk to the bottom, the foundations being afterwards built within them.

Timber camp-shedding, wooden cofferdams, fender piles, and land piles are still in common use, but much of the work of this kind goes into the hands of engineers rather than architects. If the work is in any reasonable quantity it is better to describe it in a separate section, with its characteristic preliminary clauses, rather than in the "Carpenter." Only a simple example of cofferdam has been described. The variety of design of cofferdam is very great.

Materials. The timber to be the best Dantzic; that for the cofferdam to be squared as imported, that for the camp-shedding sawn on three sides, the hewn face on the back to remain.

The whole to be selected for straightness, free from sap, large or dead knots, waney edges, and all other defects.

The whole of the timber to be examined and approved, and then creosoted under pressure with 8 lbs. of creosote to each cubic foot of timber.

Tar with Stockholm tar all cut ends, scarfs, and surfaces of tops of piles.

Piles Split or Damaged. Any pile split or otherwise damaged in driving shall not be drawn if avoidable, but cut off at the level of the river bed, and another pile driven instead as near as possible to that first mentioned, and at the contractor's expense.

Defective Piles. When piles are not driven in a line, or the sides do not range, or are not battering at the same inclination with

those adjacent, they shall be taken up and replaced at the expense of the contractor.

Ironwork. Supply all requisite spikes, staples, and dogs.

Pumping. Do all necessary pumping and baling.

Pile Engine. Supply pile engine and all necessary staging and hoops or rings for driving, also barges and floating stages which will be necessary for a part of the work.

Fender Piles. Fix to the face of the river wall fender piles 12 in. by 12 in. sawn die square, shod with wrought-iron shoes, with 4 straps 18 in. long, measured from the point of the shoe, and fixed with twelve 5 in. spikes; weight 30 lbs. in all, each pile to be driven 4 ft. into the bed of the river.

Fix to the top of each pile a cast-iron cap of $\frac{3}{4}$ in. iron to design, to finish flush with the faces of the pile and fixed thereto with nine 4 in. stoutest screws with countersunk heads. Fix each pile to the wall by 6 in. diameter galvanized screw bolts passing through the pile and the wall, with large head nut and washer at each end; that on the water face let in flush, that at the back with $\frac{3}{4}$ in. washer 12 in. square on the inner face of the wall.

To two of the piles the outer end of one of the bolts to be forged as an eye, and fitted with a 6 in. mooring ring of $\frac{3}{4}$ in. iron.

Camp-shedding. Construct the camp-shedding between the points A and B as marked on drawing No. 26, of 9 in. by 9 in. piles 7 ft. from centre to centre, and shod with cast-iron shoes, with 4 straps 18 in. long measured from the point of the shoe, weight 21 lbs. each, and secured by 12 spikes 4 in. long. Drive the piles 5 ft. into the river bed. Secure each of these piles by a galvanized iron bolt $1\frac{1}{4}$ in. diameter and 10 ft. long with large nut and washer on the river face, carried through the pile and through a block of cement concrete 3 ft. by 3 ft. by 3 ft., finished at the end with a large nut and 12 in. by 12 in. by $\frac{1}{2}$ in. iron washer. Bolt to the back of these piles at the levels shown 3 rows of waling pieces with 1 in. bolt to each pile. On the face of the waling pieces drive sheet piling 9 in. by 4 in. with close joints and going 3 ft. into the river bed. Spike each sheet pile to the walings with 2 spikes to each waling. Bolt to the top of the principal piles with a 1 in. bolt 18 in. long to each pile, and a 9 in. by 9 in. beam as capping.

Fill in behind the camp-shedding with cement concrete 12 in. thick, and fill in and ram the earth behind it.

Cofferdams. Dredge the bottom over the whole site of the intended dam.

Construct the dam as shown on drawing No. 84 of 2 rows of 12 in. by 12 in. piles, each shod with a wrought-iron shoe with 4 straps 18 in. long measured from the point of the shoe and fixed with twelve 5 in. spikes, weight 30 lbs. in all. Each pile to be driven 10 ft. into the river bed. Supply 4 rows of 12 in. by 6 in. waling pieces, each row bolted to each pile by 1 in. bolt with head nut and washer, the bolt passing through from the waling piece of one row of piles to the corresponding waling piece of the other row of piles. Fill in the space between the two rows of piles with thoroughly well tempered and plastic clay well beaten and punned.

On the land side the uppermost waling piece to be strutted by 12 in. by 6 in. struts or shores 3 ft. apart resting at bottom on a footing block with oak wedges conveniently fitted for driving and adjustment as the pressure comes on the dam.

CONCRETE BUILDINGS.—*See Notes, p. 540.*

In addition to the ordinary items of a contract there are certain special ones or variations of those before mentioned which may be required, such as the following :—

Concrete. The walls shall be built entirely of cement concrete mixed in the proportions of one of cement, two parts clean sharp sand, and three parts of clean ballast, the stones to pass $1\frac{1}{2}$ in. ring, all thoroughly mixed and used before it sets. No concrete which has once set shall be used. All concrete exposed to hot sunshine shall be covered with wet sacks until well set, and all concrete intended to be raised upon shall be kept clean.

Mode of Building. The walls and partitions shall be carried up regularly. No part shall at any time be more than 12 in. above any other part, and the top of any wall or partition shall be left rough and shall be watered to receive the next raising. The whole shall be grouted with cement, mixed one of cement to two of sand.

Collateral Works. The waller shall build in all puds, wood, bricks, wood plugs, plates, ends of timbers, iron joists, iron or wood lintels, flue pipes, air bricks, &c., and do all work in fixing or preparation for fixing so as to avoid cutting after the concrete is set.

Apparatus. He shall also supply all boarding, timber framing and strutting necessary for the construction, and shall remove it at completion, but not before the architect gives instructions to do so.

No apparatus shall be shifted for at least 12 hours after the deposit of the concrete it supports.

Centering. He shall fix and afterwards remove the centres and boarding for boarded edges to openings which will be supplied by the carpenter.

Internal Plastering. Float and set all walls and partitions, and lath, plaster, float and set all ceilings and the soffits of stairs.

External Plastering. Render and float all the external faces of walls and chimney shafts with Portland cement and sand in equal proportions jointed as stone.

Flue Pipes. Construct the flues of 9 in. unglazed, unsocketed terra-cotta flue pipes set and jointed with cement, with bends of the same material.

Lintels. Insert in all lintels a length of 2 in. by 2 in. angle steel resting 9 in. in the jambs at each end, but the concrete around it shall not be less than 3 in. thick.

Fixing Blocks. Insert for the fixing of joinery Wright's fixing blocks, not more than 2 ft. apart, all to project sufficiently to stop the plastering, grounds will not be required.

Insert wooden plugs well wetted and slightly tapering to form holes for the ends of timbers, and build into the wall as the work proceeds 2 in. No. 12 B.W.G. hooping as wall plate.

Window Sills. The window sills, steps, &c., shall be built in as the work proceeds.

ALTERATIONS, ADDITIONS, AND REPAIRS.—*See Notes, p.* 549.

In addition to the ordinary items of a contract there are certain special ones or variations of those before mentioned which may be required as the following:—

Nature of the Work. The work consists of the erection of a new eastern wing, the removal of the roof of the main building, and the erection of an additional storey, of the extension of the dining and drawing-rooms, the addition of a porch, of the remodelling of the entrance hall, the construction of a new principal staircase, the underpinning of the whole of the basement, and a number of small alterations and additions.

Gas and Water. Pay all charges for gas and water required for the works during the erection of new buildings, supply, alter, and remove, as may be required, all pipes, cocks, &c., for the temporary gas and water services, and make the necessary connections with the mains of the gas and water companies, and pay all fees in connection with same.

Pulling Down, &c. Credit. The contractor is to allow for pulling down and removing the existing buildings on the site, and grubbing up all foundations, roots, cesspools, drains, wells, walls, vaults, &c., &c., below the ground level when encountered in the excavations for the new buildings, &c. The best of the old bricks to the amount of thousands, are to be properly cleaned and stacked on site ready for re-use in the new building where directed. The remaining materials (except otherwise specified) obtained from pulling down the old buildings are to be carted away, the contractor giving credit for them in his estimate.

Clearing Site and Carting away. Fill up the necessary excavations, cart away all surplus materials, scaffolding, and rubbish, and finally leave the site clear and unencumbered.

Inserted Work. The whole of the inserted work, as mouldings, framings, cornices, &c., to be made to match the old work.

Existing Drains. The existing drains to be left in working order until the new drains are laid, and are not to be opened nor interfered with until the new system is complete. Supply all necessary temporary connections and diversions for this purpose, and remove the old system when the new one is finished.

Remove old Drains. Remove all old drains, gulleys, traps, cesspools and old foundations. The ground throughout the site to be thoroughly examined and probed with iron bars, any contaminated or offensive earth to be dug out and carted away.

Any cesspools that may be found to be emptied and entirely removed.

The whole of the voids, however produced, to be filled in in with clean sharp pit gravels, well rammed.

Extra Digging nd Concrete. Digging or concrete used beyond the quantity described or shown on the drawings or involved by the last clause shall be measured and valued at the rates of the original contract.

If any ground be taken out in error to a greater depth than that shown on drawings or without order, the contractor shall fill up the space so excavated with cement concrete like that elsewhere described at his own expense.

Under-pinning. Carefully remove in short lengths the footings of the party wall on the northern side of the site. Excavate to the depth shown and insert cement concrete 3 ft. 3 in. wide and 3 ft. deep.

Or,

Underpin in lengths of not more than 3 ft. with hardest bricks in cement the party wall on north side of the site, the footings to be 15 in. high in all, the bottom footing two courses high. Carefully pin up between the new and old work with stout slates and cement.

Timber left in Ground. Any timber which it may be necessary to leave in the ground shall be measured and valued at the rates of the original contract.

Disused Drains. Old disused drains which it may be inconvenient to remove shall at the architect's discretion be thoroughly cleaned out with rods, thoroughly flushed, cleaned and completely filled up with cement concrete pushed in from the ends and rammed.

Bonding New Work to Old. Cut toothings for and thoroughly bond the new work to the old.

Level Old Work for Raising. Remove any loose courses, level, grout, and prepare the old walls to receive the new work.

Hall's Tiles. Rake out joints, hack where necessary, and dub out with cement to a level surface the old walls of larders including the internal reveals of window openings, and float with cement nowhere less than $\frac{3}{4}$ in. thick, and fix thereon from floor to ceiling Hall's best ivory-white enamelled tiles set in Parian cement. Finish the salient angles of jambs and heads of windows with glazed rounded tile angle to match.

Shoring. "Carefully shore up and support the whole of the floors and roofs and walls of the house No. on the northern side of the site after the pulling down of the party-wall. Inclose that property with 1 in. rough boarding, and quarters papered on each side with thick brown paper, and maintain it intact until the new party-wall is built; remove at completion, and make good all work disturbed or injured in the house above mentioned in all trades to match the old work."

"Take down the wall on south side of yard in lengths of not more than 4 ft. at a time, support the roof and gutter adjoining, and make good and reinstate all the work disturbed after building of new wall."

> Such a clause as the foregoing is necessary when parts of an old building are demolished.

Pull down. Pull down the whole of the existing buildings on the site, and its vaults and appurtenances, and grub up the whole of the foundations; efficiently shore up the adjoining properties to the satisfaction of the architect and the local authorities; remove and alter the shoring during the progress of the works, and remove at completion. The contractor shall be responsible for and make good at his own expense any damage to the adjoining property which may occur as a consequence of this pulling down and the building operations.

Watering. The contractor shall thoroughly water the work during the pulling down by a jet of spray from a hose laid on from the water main, sufficient to prevent any nuisance to the

adjoining owners from dust, and to the extent prescribed by the architect.

Old Materials. The old materials shall be the contractor's property. The old York stone may be dressed and used for templates. The sound old bricks, after cleaning, may be used in the body of the walling, but no sooty bricks shall be used on the face of any wall. The whole of the remaining old material shall be removed from the site immediately after it is taken down.

> The practice of selling an old building to a housebreaker, although it involves the payment of a certain sum by him for the old materials, is often troublesome and otherwise unsatisfactory. As a rule, it is far better to leave the matter to the general contractor for the new building, and let him state the amount of credit in his tender.

Order of doing the Work. Each section of the work shall be done in the following order:—

Firstly, the western wing.
Secondly, the new upper storey.
Thirdly, the remainder of the contract work.
Each section to be entirely completed before the succeeding one is commenced.

Facilities for Continuing Business. The business of the building owner will be carried on during the time allotted for this contract. The builder shall not interfere with the access to the shop windows or entrance, and shall afford every possible and required facility for the conduct of the business.

It is required to carry on the work of the first-class swimming bath, the first and second-class entrances, the boiler house, coal store, engine room, and establishment laundry uninterruptedly during the whole time of reconstruction, and the second-class swimming bath for a portion, if not the whole of the same period, and the contractor must so order his work as to permit of this.

Precautions. The contractor shall take all needful precaution against injury to the house and property, and shall also give notice to servants or persons in charge of the premises to remove or cover up furniture, &c., in any apartment required to be

used for the carrying out of the work, and which would be liable to damage by workmen.

Supply drop-cloths for the staircases and elsewhere, and lay footboards on the steps, passages, landings, &c., and wherever necessary to prevent injury to the house and furniture.

No workman shall make a fire in any stove without first obtaining permission either from the inmates of the house or the clerk of works, and if the stove has a boiler care must be taken that it is kept full of water.

Make good Damage.

The contractor shall, without extra charge, make good all damage that may occur, whether from accident or negligence, during the progress of the contract. That is to say, he shall repair all injury whatever to rooms, floors, skirtings, stoves, drains, gas, or water pipes, furniture, glass, china and the like, or compensate for the same, if required.

All paint, paper, colouring, whitewash and the like that may be disturbed, injured, or discoloured, must be made good as found. Proper paint, paper, &c., must be put on, and, if necessary to avoid a break, the colouring must be extended over the whole of the ceiling, walls, &c.

The contractor shall provide, at his own cost, all coal or lights that may be required to carry on the work. If he uses the gas as laid on to the house he must pay for the same according to the meter readings.

CHURCH RESTORATION.—*See Notes, p. 554.*

In addition to the ordinary items of a contract there are certain special ones, or variations of those before mentioned, which may be required, as the following:—

Suspension of Works.

It shall be lawful for the contractees, by notice in writing under the hand of the architect, to be given to the contractor or left for him on the works, to require him to suspend or discontinue at any time the performance and execution of the works either wholly or for such period as the contractees in their discretion shall think fit, and the contractor shall, upon the withdrawal of such notice, as aforesaid, and when required so to do, resume and complete the execution of the works, according to the terms of this agreement. The contractor shall not take away any materials brought by him or by his order, and left upon or near the site of the works, without the consent of the architect previously obtained, and in the event of his doing so he shall pay or allow to the contractees the sum of £50 by way of liquidated and agreed damages.

Take down and Deposit Tablets, &c.

Before commencing other works take down in the most careful manner all the mural tablets in and about the church which may in any way be interfered with by the additions or alterations. Store, case, and preserve them. Clean, repair, and refix where directed by the vicar or the architect. Supply all materials, copper cramps, &c., that they may deem necessary.

Case and Protect, &c. Monuments.

Thoroughly case and protect those which do not require removal.

Make good any damage done to the tablets, monuments, tombs, &c. Carefully take up, store, protect, and refix where directed in the paving of the church all old footstones, slabs, and brasses.

Remove Bodies and Fill up Vaults. Carefully examine all vaults which may exist under the floor of the church, and dispose of the bodies and remains as may be directed by the vicar and churchwardens, and, except where otherwise directed by them, fill in with cement concrete, thoroughly rammed.

Disposal of Earth. All the excavations in the churchyard shall be made under the direction and to the satisfaction of the vestry authorities. All proper precautions to be taken, and disinfectants used as they may direct. None of the material excavated from the churchyard shall be removed from the premises, but it shall be deposited on the site in heaps, as directed.

Fill up such graves and vaults as may be disturbed by the addition to the exterior, with concrete.

Avoid Disturbance of Graves. No graves or gravestones shall be disturbed unless it shall be absolutely necessary.

Precautions with Scaffolding. No scaffold pole, post, or strut shall be fixed in any grave or vault. The feet of either shall be supported by stout timbers laid across such graves or vaults.

Removal and Reburial of Bodies. Any necessary removal of human bodies shall be carefully and decently done, and they shall be reburied where directed at a depth of at least 5 ft. below the finished surface, and the excavation filled in with hard dry material. No graves, coffins, or bodies shall be exposed to public view.

Any faculty required for the removal of bodies will be obtained by the vicar.

Protection of the Building. Supply all requisite tarpaulins and temporary roofs, and effectually protect the building from damage by inclement weather. Protect the old walls where exposed by the pulling down and the new walls in course of erection from injury by excessive wet or frost with sheets of asphalted felt.

Responsibility for Accident. The contractor shall thoroughly examine and make himself perfectly acquainted with the church before making his estimate, as he will be held responsible for any impediments or accidents which may hinder the execution of the works, and he shall make good all costs or injury thereby to the building or its adjuncts.

Repair Settlements. Effectually repair, amend, and rectify to the satisfaction of the architect all settlements, cracks, or other defects which exist or may at any time occur in the general walling, new and old, and all damage by reason of accident, or from

any cause whatever during the progress of the work, or within the period of maintenance prescribed by the contract.

Leave all Clean and Perfect. Leave the whole of the churchyard and church clean and clear at conclusion of works; repair, make good, and perfect the paths, cartways, turf, and graves when in any way damaged by the works.

Shore and Needle. Carefully shore and needle where required by the alterations.

Repair Foundations. Thoroughly examine, take up, rebuild, repair and otherwise reconstruct such parts of the old foundation as may require it.

Clean and Sort Old Materials. Clean, sort and stack for reuse, in such positions as may be directed, all undecayed stones, tiles, pavings and other materials, for submission to the architect.

Clean, sort, stack and protect from the weather, for submission to the architect, all old framing, seats, boarding timbers, &c., which may be sound.

Use of Old Materials. The old materials so far as sound and approved by the architect may be reused, and the remainder shall be the contractor's property, and shall be carted away by him.

Repair Facing. Cut out all decayed parts of the general facing, make good with new, and point with a neat weather joint in cement.

Remove, number the stones, and deposit, protect, repair and refix in new position the old font and its steps.

Clear off Plaster and Limewhite. Remove all plaster, limewhite and accretions from the walls and general stonework externally and internally, but do not remove the old faces of the stone.

Take down Western Pinnacles. Carefully take down the stones of the two pinnacles of western front, number and letter the stones on bed or joint, and deposit them under cover for future use.

Repair Existing Worked Stone. Examine and effectually repair the whole of the existing worked stone, such as sills, jambs, mullions, tracery, arches, plinths, labels, strings, buttress slopes, coping, bond and saddle stones throughout the building, internally and externally, cutting out all defective stones and making good with new of the same moulding and size as the old, but no stone shall be drawn until the architect has inspected it.

Take up Paving. Take up the whole of the paving of nave and aisles. Excavate the ground beneath for a depth of 6 inches, and lay cement concrete 6 in. thick to receive the new paving.

Remove Roofs. Remove the roofs of north aisle, chancel, and south aisle. **Remove Gallery and Seats.** Take down the western gallery and its appurtenances, remove the seating throughout, and the altar rail and supports.

Remove the old pulpit and reading desk. A sum provided for new ones (see "Provisions").

Reinstate Roofs. Thoroughly restore in oak to match the old the roofs of the chancel aisles, the defective parts to be removed and replaced with new to match the old, the moulded parts to be carefully copied from the old work.

Iron Straps and Bolts. Supply all wrought-iron straps, bolts, stays, &c., as may be necessary or directed for strengthening the old framing of roofs and tower.

Ironwork of Doors. All the old ornamental ironwork of the doors shall be removed and repaired and refixed on the new doors.

Repair Lead Work. Repair and reinstate the lead work of the chancel and aisle roofs as may be necessary, and leave it perfect and complete.

Repair Glazing. Examine and repair the old leadlights and glazing, making good to match the old, and reusing the old glass wherever possible.

CHURCHES.—*See Notes, p. 553.*

In addition to the ordinary items of contract there are certain special ones, or variations of those before mentioned, which may be required, as the following:—

Scaffolding. Allow for all scaffolding rods, stakes and labour required for setting out the works.

The summit of the spire will be 95 feet from the ground, of flèche on the nave roof 58 feet from the ground.

Fix Groined Roof after Covering in. Supply extra scaffolding and labour for fixing groin ribs and cells after the roofs are covered in.

Protect Masonry and leave Clean. Case or otherwise protect the masonry steps and staircase during the execution of the works. Clean off all stains from the stone work, and clean down and leave the whole perfect at completion.

The masonry to be so truly worked as to require no cleaning off beyond washing.

Stone shall be worked on the Site. The whole of the stone to be worked on the site of the church, and particular care to be taken to preserve all the joints of the stonework from an irregular appearance consequent upon breaking of the arrises of the stones before setting. No work thus injured shall be set.

Graves and Gravestones. No graves or gravestones shall be disturbed unless it shall be absolutely necessary. Gravestones which might be injured by remaining in their original position shall be carefully removed, safely stored and protected until the completion of the works, and afterwards relaid or refixed in their original position.

Protect Monuments. The contractor shall efficiently protect all the monuments and gravestones during the time of his possession of the site, and shall make good to the architect's satisfaction any damage referable to these works, or the action of his workmen.

Removal of Bodies. Any necessary removal of human bodies shall be carefully and decently done, and they shall be reburied where

directed. No graves, coffins, or bodies shall be exposed to public view.

No Timbers shall be fixed in Graves.

No scaffold pole, post, or strut shall be fixed in any grave or vault. The foot of either may be supported by a stout timber laid across the grave.

Faculty for Removal of Bodies.

Any faculty required for the removal of bodies shall be obtained by the vicar.

Alternative Price for Oak instead of Deal.

Contractor shall state in his tender for what further sum he will be willing to execute the whole of the work described in the joiner's specification in best dry Riga wainscot oak instead of deal.

Protection of Works and Buildings.

Supply all requisite sheds, boards, tarpaulins, &c., to protect the works, workmen, and materials from the weather. The walls in time of severe frost or excessive wet are to be well and carefully covered with sheets of asphalted felt.

Provisions.

Provide the sum of £100 P. C. for carving and models, the work to be done by carvers selected by the architect.

Provide for wrought-iron gate painted and fixed complete for turret stair, £10 P. C.

Provide for two pairs of wrought-iron folding gates in Porches, painted and fixed complete, £40 in all.

Provide for lightning conductors and copper-plate to flèche, £15 P. C. at the manufactory, and allow for carriage, fixing, coke, and digging complete.

Provide for wrought-iron finial for flèche £12 at the manufactory, and allow for boring centre post, fixing and painting 2 oils.

Provide for laying out the grounds and forming paths, £50.

Provide for boundary fences, £150.

Provide for foundation stone and inscription, £8.

Provide for font with steps and waste, £30.

Provide for wire lattice to windows, and fixing, £15.

Provide for 2 stoves and 2 chimney-pieces in vestries, £10.

Provide for gas fittings and fixing, £70.

Provide for bell, carriage, rope and fixing, £40.

Provide for glass and fixing in Eastern window of chancel, £100.

Provide for pulpit and reading-desk, £150.

Fires. Build the flues and set the stoves in brickwork in mortar, finish the flues with fire-clay chimney pots 12 in. diameter and 2 ft. long, set and flaunched with cement.

Well beneath Font. Build beneath the font a well 3 ft. by 2 ft. by 3 ft., all in clear, of 9 in. work laid dry, with 4 in. tooled York cover, 4 ft. 6 in. by 3 ft. 6 in. perforated for the waste pipe.

Brick Filling in Bays of Vaulting. Fill in and carefully fit to the stone ribs of groined ceilings of porches half brick thick groin cells of Lawrence's (Bracknell) best red rubbers, the soffits slightly arched or cambered, cut, rubbed, and gauged and set in fine putty.

Paving of Heating Chamber. Pave the heating vault with blue Staffordshire bricks set and grouted with cement.

Paving of Chancel. Pave the chancel, the porches, and the baptistery with Staffordshire 4 in. by 4 in. red tiles laid diagonally, and about one-sixth part narrow red and blue tiles in borders, and margins bedded in cement, the joints left open and flushed with liquid cement, the whole arranged to a design to be supplied.

Paving of Passages of Nave and Aisles. Pave all the passages of nave and aisles with yellow deal wrought blocks, 12 in. by 3 in. by 1½ in. laid herring-bone with one row of blocks as straight border all in mastic, every block gauged, cleaned off, and traversed at completion and grouted with fine dry Portland cement well brushed into the joints.

Sleeper Walls. Build up from the footings of the main walls half brick sleeper walls.

Build on the concrete beneath the boarded floors, about 5 ft. apart, one brick sleeper walls, with one course of footings.

Walling. The rubble for the walling shall be Kentish ragstone from an approved quarry, lined with sound hassock, laid in lime mortar as described, and grouted every 18 in. in height. All the footings shall be of large through stones. All stones to be laid on their natural quarry bed, and the walling to have a bond stone at least 12 in. by 12 in. on face, and 18 in. long, to every superficial yard of wall. Level up for masonry damp-proof courses, steps, plates, &c., and carefully bond the rubble to the freestone work.

Face the wall with similar stone from the best quarry beds only, and all stone to be picked. The facing shall be

cleft-faced, square-jointed, irregular coursed rubble, raked out and pointed with blue ash mortar.

Angle of Brick. The internal and salient angles inside the building shall be formed in hard stocks.

Build Specimen Wall. Build a piece of rubble walling faced as described about 2 yards superficial and 24 in. thick as a specimen for approval before commencing the work, and pull it down and clear it away when directed after the completion of the walling of the building.

Relieving Arches. Turn neatly hammer-dressed relieving arches in the facing over all labels of windows and door heads 9 in. deep to the openings up to 5 ft. wide and 12 in. deep to those beyond that width, the beds equal in width to that of the beds of the stonework of the head.

Ragstone Facing. Face the brick walls throughout with hammer-dressed random facing, raked out and pointed with blue ash mortar.

Finish the salient angles with 1 in. chisel draft on each return as quoin.

Finish of Barnack Stone. The Barnack stone shall be finished with a finely chiselled face in irregular upright and diagonal strokes similar to the finish of Norman work.

Stone shall be Set with Wide Joints. The whole of the stone shall be set, bedded, and jointed in fine mortar with wide joints which shall show.

Internal Angles of Stone to be out of Solid. All internal angles of dressed stonework shall be out of the solid.

Bath Stone.

Quality. The Bath stone to be Monk's Park of the best quality, finished with a finely dragged face.

Fluate. The whole of the exposed surfaces of the external work after they are cleaned down to have two coats of fluate mixed and laid on as directed by the Bath Stone Company.

The whole of the following work to be executed in Bath stone:—

The windows and their dressings, the doorways and their dressings.

The nave arcades, the chancel arch and its dressings.

The internal cornices, the corbels to roof principals and purlins, the external crosses, copings, plinths, string courses, quoins, chimney caps, spire, buttress, weatherings, and gablets.

Spire. The beds of the spire above the squints shall be at right angles to the face, and the whole of the stones shall be V-joggled and run with cement. The top of the spire shall be in one stone 5 ft. in height; the base course of the spire shall be not less than 18 in. high. Every joint shall have two copper cramps 12 in. long, 1½ in. by 1 in. let into the top bed and run with cement.

The top stone of spire to be pierced its whole depth for the rod of vane, which shall be secured with a large nut.

Roof of Porch. Construct the groined roof of the porch to detail with solid springers in one stone; the filling in between the ribs shall be of stone 4½ in. thick, and in courses 3 in. to 5 in. wide, carefully fitted to the ribs and coursed to detail.

Ashlar. Face the inside of porch with ashlar in regular courses, varying from 5 in. to 10 in. high, and bedding on wall 9 in. and 4½ in. alternately.

Dowels. Each joint of mullions and transoms to be dowelled with a 1 in. by 1 in. by 4 in. slate dowel set in cement. Those larger than 10 in. by 6 in. to have two.

Each finial or gable cross to have 1 in. by 1 in. by 12 in. copper dowel in cement.

Copper Ties. Connect the detached shafts with the jambs at the alternate joints by a ½ in. by ¼ in. copper tie 8 in. long, built in.

Lead Pads to Beds of Columns. Each bed of the columns of nave arcade to have a plate of 6 lbs. lead 1 in. smaller than the diameter of the column.

Cement Plugs and Joggles. Each vertical joint of copings, sills, strings, cornices, and tracery shall have a cement plug or double arris grooves run with cement.

Slating. Cover the conical roof of the baptistery with slating of Tilberthwaite best green slates, "peggies" laid to a 3½ in. lap, with two 1¼ in. copper nails to each slate.

Carving. Leave stones projecting sufficiently to allow of the carving of the bosses to hood mouldings, the capital of the columns and the corbels of responds of nave arcade, the columns of doorways and chancel arch and corbels to roof principals.

Shingles. Cover the spire of flèche with rent English oak shingles laid to a 3½ in. gauge, each shingle nailed with two 1¼ in. copper nails.

Lay the eaves double, closely and neatly cut and fit the hips.

All Timbers shall be Wrought. The whole of the timbers to be wrought, where exposed to be moulded, cut, and chamfered as shown by the drawings.

Mouldings to be on Solid. All mouldings, splays, stoppings, and mitres to be worked on the solid, the wrought parts to be clean, and kept clean.

Carpentry to be put together on the Site. The whole of the carpenter's work to be put together on the site.

Roof of Nave in Oak. Construct the roof of nave (Fig. 30) entirely of oak as described, the whole of the timbers, except the plate, to be

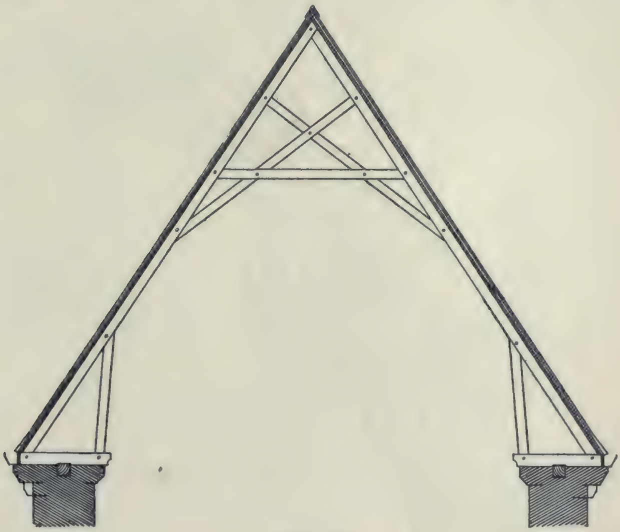


FIG. 30.

wrought all around and laid flat wise. The whole shall be framed and pinned with stout oak pins, the rafters halved together at the apex. The intersections of the braces with the collar and each other shall be halved together, the ends of the wall pieces shall be shaped to detail, and the wall pieces shall be cogged on the wall plates, the trusses shall be 1 ft. 8 in. apart. The scantlings shall be as follows :—

Plates, 6 in. by 6 in.
Wall pieces, 6 in. by 6. in.
Rafters and collar, 6 in. by 4½ in.
Struts and braces, 6 in. by 4½ in.

Roof of Nave in Oak. Cover with $1\frac{1}{4}$ in. wrought oak boarding, tongued, grooved, and V-jointed in $4\frac{1}{2}$ in. widths.

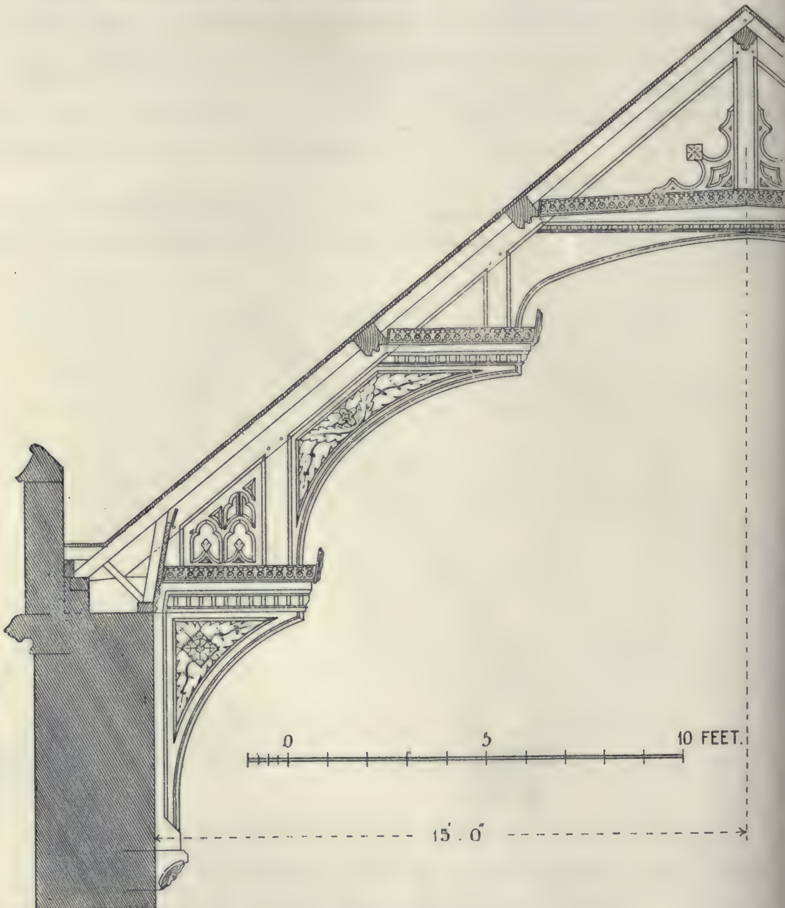


Fig. 31.

Lay on the boarding diagonally 2 in. by 2 in. deal fillets 12 in. apart to receive the tile laths.

Strutting and Ribbing to Windows. Supply all requisite strutting and ribbing to the windows.

Wooden Floors. The boarded floors to have plates $4\frac{1}{2}$ in. by 3 in., joists $4\frac{1}{2}$ in. by 3 in.

Finish the edges of the flooring under seats with 6 in. by 3 in. oak rebated and chamfered curb.

Skirtings. Put 1 in. by 7 in. chamfered skirting to organ chamber and vestries.

Roofs of Vestries.

Construct the roofs of the vestries of 5 in. by 3 in. moulded plates, purlins 8 in. by 4 in., ridge 11 in. by $1\frac{1}{2}$ in., trussed rafters and braces $4\frac{1}{2}$ in. by 3 in., hammer beams and struts $4\frac{1}{2}$ in. by 3 in., all laid flatwise, and the ends of the hammer beams moulded. Cover with 1 in. wrought one side boarding V-jointed, tongued, and grooved in $4\frac{1}{2}$ in. widths.

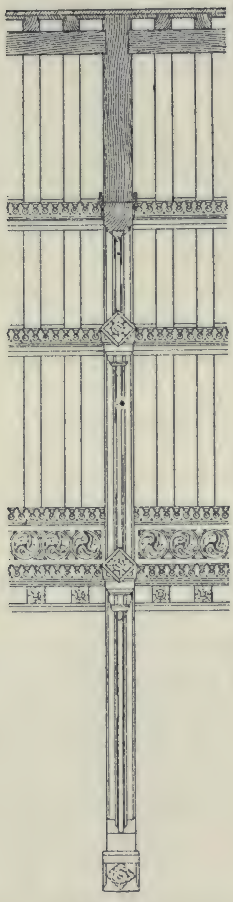


FIG. 31A.

Roof of Chancel.

Construct the roof of chancel of trussed rafters, braces, struts, and wall pieces $5\frac{1}{2}$ in. by 3 in. halved and pinned together with oak pins, plates $5\frac{1}{2}$ in. by 4 in., two purlins 8 in. by 5 in. Fir the underside of rafters and braces with 3 in. deal cut to a circular face to form barrel vault. Line with 1 in. wrought one side, tongued, and grooved boarding in 3 in. widths. Put 9 in. by 6 in. deal moulding as cornice, divide the vault into panels by 4 in. by 2 in. moulding, with 2 in. by 2 in. moulding against the walls. Fit to each intersection of the ribs a 9 in. by 9 in. carved boss 3 in. thick scribed over the mouldings, and screwed with four 6 in. screws, the heads let in, and pelleted half bosses against the end walls to match. Cover with 1 in. rough boarding.

Roof of Transept.

Construct the roofs of transepts with plates $4\frac{1}{2}$ in. by 3 in., ridge 10 in. by 2 in., purlins 7 in. by 4 in., pitching pieces as valleys 6 in. by 3 in. Cover with 1 in. wrought one side boarding in $4\frac{1}{2}$ in. widths V-jointed, tongued, and grooved.

Put to each arm of the transept a truss of wall pieces, principal rafters, and collars 9 in. by 6 in., posts 6 in. by 7 in., 4 in. circular ribs twice rebated on their back edges, and let into a groove in the adjoining timbers, and grooved and rebated together at the joints. Secure each truss with

$2\frac{1}{2}$ in. by $\frac{1}{2}$ in. wrought-iron straps, each bolted with five $\frac{1}{2}$ in. bolts 6 in. long, and ten $\frac{3}{4}$ in. with heads and nuts, and a 3 in. cast-iron ornamental cup washer 3 in. diameter to each bolt.

Roofs of Aisles. Construct the roofs of aisles of trusses with principal rafters, collars, and wall posts 10 in. by. 6 in., 4 in. circular ribs as to other roofs. Secure each truss with one $2\frac{1}{4}$ in. by $\frac{1}{2}$ in. wrought-iron strap 4 ft. 6 in. long, bolted with four $\frac{1}{2}$ in. bolts and six $\frac{3}{4}$ in. bolts, all with cup washers as before, plates 4 in. by 4 in., rafters $4\frac{1}{2}$ in. by $2\frac{1}{2}$ in. Cover with 1 in. boarding in $4\frac{1}{2}$ in. widths.

Roof of Nave. Construct the roof of nave (Figs. 31 and 31A) entirely of oak as described, and to details to be supplied, the whole wrought all around, framed together in the best manner and pinned with stout oak pins.

The trusses (five) shall be constructed of principal rafters 10 in. by 9 in., king post 7 in. by 9 in., collar beam 10 in. by 9 in., upper struts 8 in. by 9 in., lower struts 9 in. by 9 in., lower hammer beams 11 in. by 9 in., upper hammer beams 10 in. by. 9 in., the exposed angles of these timbers to be hollow moulded $1\frac{1}{2}$ in. girth. The cusping above the collar and above the lower hammer beams shall be 6 in. thick, hollow moulded both sides, housed 2 in. deep into the timbers adjoining, and pinned with oak pins.

The circular ribs shall be 4 in. thick, housed 2 in. into the timbers, and pinned with oak pins. They shall each be out of a single piece of wood, except the topmost rib, which shall be in two dowelled and keyed at the apex.

The wall pieces shall be out of 9 in. by 8 in. sunk and moulded.

Carefully notch the mouldings and clean up the notchings.

Secure the principal rafters to the lower hammer beams by $2\frac{1}{2}$ in. by $\frac{1}{2}$ in. wrought-iron straps, each bolted with two $\frac{3}{4}$ in. bolts.

The pateræ on the faces of hammer beams shall be 3 in. thick, each pinned with two oak pins to a piece of 9 in. by 5 in. framed to the strut behind it.

The ridge shall be 6 in. by 5 in., moulded to detail, and framed, and pinned to the principals.

The purlins shall be 8 in. by 7 in., moulded to detail, and framed, and pinned to the principals.

Roof of Nave. The common rafters and struts shall be 6 in. by 4 in., laid flatwise, and halved and pinned together.

The wall plates shall be 5 in. by 4 in. and 4 in. by 3 in. respectively. The cornice shall be $1\frac{1}{2}$ in. thick in two pieces, cross-tongued together and moulded to detail.

The enriched moulding on faces of principal trusses, cornice, and purlins shall be 5 in. by 2 in. carved to detail carefully, mitred and pinned with oak pins.

Cover the roof with $1\frac{1}{4}$ in. wrought one side boarding, cross-tongued and grooved and stout inodorous felt, properly lapped and nailed with clout nails.

Lay thereover 2 in. by 2 in. deal strips 12 in. apart fixed diagonally.

The spandrils, enriched mouldings, and pateræ shall be carved by a carver to be selected by the architect, and for this work a sum is provided (see "Provisions"), but the general contractor shall prepare the whole, and shall mould the margins of the panels.

Main Roof. Construct the roof of nave with trusses of scantlings as follows: principal rafters, upper collars and posts 10 in. by 6 in., wall posts 9 in. by 6 in., the latter with moulded ends, 4 in. circular ribs twice rebated on back edge let into grooves of adjoining timbers and grooved and rebated together at joints. Secure each truss by two $2\frac{1}{2}$ in. by $\frac{1}{2}$ in. wrought iron straps, each 5 ft. 9 in. long, and bolted with three $\frac{1}{2}$ in. bolts, two similar straps each 4 ft. 6 in. long with four $\frac{1}{2}$ in. bolts, two similar straps each 6 ft. 6 in. long with four $\frac{1}{2}$ in. bolts.

Similar strap as stirrup 5 ft. 9 in. long with six $\frac{1}{2}$ in. bolts, the strap increased in size on each side of the truss to form ornament to design.

Each truss to have in addition fourteen $\frac{3}{4}$ in. bolts, with head, nut, and cast-iron ornamental cup washer 3 in. diameter. Spike to the back of principal rafters 10 in. by 6 in. by 6 in., shaped cleats for purlins.

The purlins to be 8 in. by 5 in., scarfed where required with three $\frac{1}{2}$ in. bolts to each scarfing, ridges 11 in. by 2 in., plates 4 in. by 4 in., rafters $4\frac{1}{2}$ in. by $2\frac{1}{2}$ in.

Cover with 1 in. boarding in $4\frac{1}{2}$ in. widths, wrought one side, grooved, tongued, and V-jointed.

Felt and Diagonal Fillets. Lay over the boarding of all roofs stout inodorous felt, lapped and nailed with clout nails, and $1\frac{1}{2}$ in. by 1 in. deal fillets 12 in. apart, laid diagonally to receive the tile laths.

Flèche. Construct the flèche on nave roof to detail of horizontal sills extending from principal rafter to principal rafter 11 in. by 6 in. and bolted thereto with 1 in. bolts, braces 5 in. by 3 in., hips 11 in. by 4 in., sill of open part 6 in. by 8 in. Construct the open part of angle posts 10 in. by 10 in., and splayed and chamfered heads 6 in. thick, shaped, chamfered, and cusped. Construct the cupola of centre post out of 6 in. by 6 in. diminished as shown, horizontal struts 6 in. by 4 in., and rafters 4 in. by 2 in., firred up and shaped in 2 in. deal to the contour of the roof cover with 1 in. rough boarding in narrow widths, with hollow moulded eaves fillet, and 2 in. rounded rolls for lead, the moulding, the roof, and the centre post above the roof to be covered with lead.

The exposed struts at hips to be 11 in. by 6 in., the upper parts curved and framed to the angle posts.

Finish around eaves of cupola with 6 in. by 4 in. moulding as cornice.

The cornice at base of open part to be out of 7 in. by 5 in. mitred around, exposed struts or hips, and with 3 in. by 3 in. bed moulding.

Cover the base (below the open part) with $1\frac{1}{4}$ in. rough boarding, and $1\frac{1}{2}$ in. deal rolls in geometrical pattern.

Form a flat at base of open part with 1 in. rough boarding on the necessary bearers trimmed for and fitted to the ventilator, and prepared to receive lead.

Form soffit to the base of the cupola with $\frac{3}{4}$ in. matched and beaded boarding.

Fix the vane with 1 in. bolt passing completely through the centre post.

Fix the exhaust ventilator supplied.

Floors. Lay the floors not otherwise described with $1\frac{1}{4}$ in. yellow battens, laid straight joint with splayed headings, and grooved and tongued with $1\frac{1}{4}$ in. hoop iron painted two coats.

Deal Doors. The whole of the doors to have wide rails and blockings as required to receive the hinges, locks, &c.

The doors north and south of baptistery to be 6 ft. by 7 ft., $2\frac{1}{2}$ in. deal doors, in four panels the set, converted on the

Deal Doors. inside into eight panels, the lower panel of each leaf filled in flush with 1¼ in. grooved, tongued, and moulded both sides boarding in 3 in. widths, the upper panel with 1½ in. moulded bars as sash, with movable mouldings fixed with brass screws and cups. On the outside mark the lines of the inside rails with 2 in. wrought-iron nails, with ornamental heads. Hang with Archibald Smith's swing hinges to swing both ways, the boxes let into the thresholds and run with lead.

Fit each pair of doors with two heavy brass spring door catches let into the tile floor and run with cement.

Fit each leaf with one 9 in. by ¾ in. and one 12 in. by ¾ in. brass flush bolt, the lower bolts to have iron thimbles let into the thresholds and run with lead, and two brass grip handles. P. C. 10*s*. each.

The frames to be 4½ in. by 4 in. hollowed for the doors, and twice moulded. Round both edges of each leaf of the doors.

The doors in northern and southern wall of chancel and between northern porch and choir to be 3 ft. by 7 ft. 3 in., 2 in. deal framed and braced covered with 1 in. grooved, tongued, and V-jointed both sides boarding in 4 in. widths, hung with wrought-iron strap hinges to detail with screwed plates and countersunk holes, each hinge bolted with five ½ in. bolts, with ornamental heads and nuts. Fit with wrought-iron latch and closing ring, P. C. 10*s*., in all, and 6 in. upright mortise dead lock. The frames to be 5 in. by 4 in. rebated, and twice ovolo moulded.

Oak Doors. The vestry doors to be 2 in. *oak* framed doors with 5 in. by 2 in. solid stiles, with 1 in. ledges and braces filled in flush with 1 in. grooved and tongued boarding in 5 in. widths, tongued to the stiles and nailed with wrought-iron nails with ornamental heads in patterns to design. Fit each door with a set of ironmongery comprising hinges, lock and latch. P. C. 45*s*. at manufactory.

The frame to be 4½ in. by 4 in. oak rebated and twice ovolo moulded.

The doors of western porches shall be of 2½ in. oak, 4 ft. by 7 ft., with 5 in. by 2½ in. solid stiles and 2½ in. by 1¼ in. square framing in panels about 9 in. square, covered with 1¼ in. grooved and tongued boarding, flush on the

outside with the stiles tongued to them and nailed in ornamental patterns as before, hang with ornamental wrought-iron strap hinges to design with stout fanged hooks let into the stone and run with lead. Fit with two wrought-iron bolts, P. C. 30*s.* each to design, and an oak stock lock, P. C. 30*s.*, with wrought-iron box staple let into the jamb stone and run with lead.

Pattern Bench. The contractor shall prepare and deliver at the building a pattern bench for the architect's approval before the others are made.

Benches. The benches (Fig. 32) to be of selected pitch pine to detail finished with the plane or scraper, without glass paper, and kept clean for varnishing, all carefully housed and put together in the best manner.

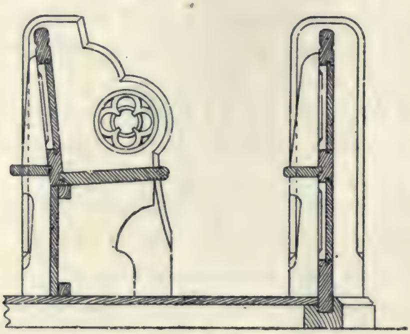


Fig. 32.

The seats shall be $1\frac{1}{4}$ in. wrought both sides, rounded on front edge and rebated and let into the backs, the corners to be rounded. The seat backs shall be 2 in. thick, framed one panel high, the stiles and rails stop-chamfered and filled in with $\frac{3}{4}$ in. matched and V-jointed both sides boarding in $3\frac{1}{2}$ in. widths. The upper edge of the top rail to be rounded and to be grooved on both faces, the backs to be housed into the ends and screwed with 2 in. screws, the heads let in and pelleted.

Frame the seat fronts to match the backs, but two panels in height. Support the seats by $1\frac{1}{2}$ in. standards about 2 ft. apart, shaped to design and housed into the seats and the floor.

The ends to the seats to be 1 ft. 7 in. by 3 ft. 3 in., including the tenons, 2 in. thick, shaped and pierced to design, stop-chamfered on all exposed edges and with moulded stops, housed their whole thickness into the oak curb 2 in. deep, and pinned with two 1 in. oak pins.

The ends against external walls may be wrought and chamfered on one side only.

Benches. The ends to the seat fronts to be 9 in. by 3 ft. 3 in., shaped to design and stop-chamfered as before.

The backs of the seats shall be stiffened by $1\frac{1}{2}$ in. standards 2 ft. apart, 6 in. by 3 ft. 3 in., shaped to design, stop-chamfered and housed into the floor.

The book boards shall be 5 in. by $1\frac{1}{4}$ in. rebated on back edge and let into the bottom rail of the seat back, the ends housed. Support the book board by $1\frac{1}{4}$ in. wrought and shaped brackets $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in., 2 ft. apart.

Fill the space below the seats of the back benches next to the aisles with 1 in. matched and V-jointed one side boarding with 2 in. wrought fillets nailed to the floor.

Cloak Rail. Supply to each seat $1\frac{1}{4}$ in. oak cloak rail (Fig. 33), supported at each standard by a brass eye on plate, and housed at the ends into the bench ends.

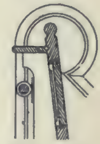


FIG. 33.

Hat Cords. Screw into the underside of seats about 2 ft. apart a set of four stout brass eyes, and strain between each pair of eyes best white flax blind cord to receive a hat.

Choir Seats. Construct the choir seats to detail (Fig. 34), the back

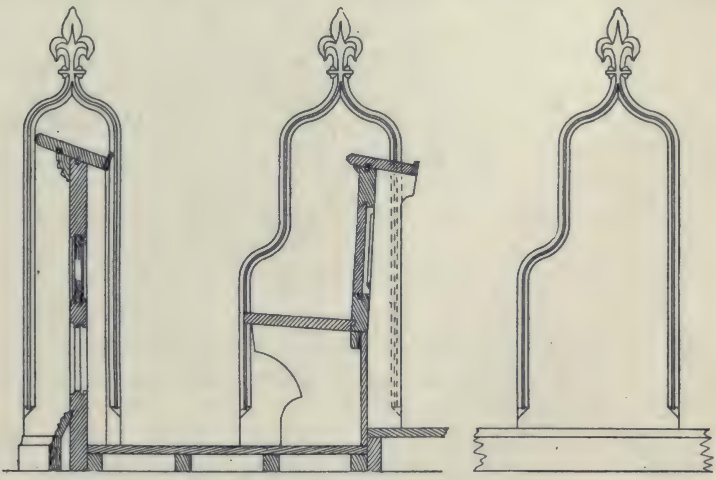


FIG. 34.

row to have seats and backs as described for the nave seats.

The ends to be $2\frac{1}{4}$ in. thick moulded and carved to detail, tenoned and pinned to the oak curb with oak pins.

Choir Seats. The front seat to be $1\frac{1}{4}$ in. wrought both sides, rounded on front edge and tongued to the back.

The back to this seat shall be 2 in. thick, framed one panel high, the stiles and rails stop-chamfered and filled in with $\frac{3}{4}$ in. matched and V-jointed both sides boarding in $3\frac{1}{2}$ in. widths, the back to be housed into the ends and screwed with 2 in. screws, the heads let in and covered.

Finish the top of the back with 1 in. book board 9 in. wide, tongued on, twice ovolo moulded, the front edge of the book board and screw on the back edge $1\frac{1}{4}$ in. by $\frac{3}{4}$ in. moulded fillet. Fit beneath the projecting front of book board $1\frac{1}{4}$ in. by $1\frac{1}{4}$ in. bed moulding.

Fix to the back $1\frac{1}{2}$ in. standards, shaped to detail, and about 2 ft. apart.

Support the seat by $1\frac{1}{2}$ in. shaped standards, about 2 ft. apart, housed into seat and floor.

Fill in the space below the seat with 1 in. matched and V-jointed one side boarding with 2 in. by 2 in. fillet under seat.

Construct the front of choir seats with 2 in. framing, moulded on solid one side and stop-chamfered the other. Fill in the lower panels with 1 in. matched and V-jointed both sides boarding in $3\frac{1}{2}$ in. widths, the upper panel with $1\frac{1}{4}$ in. pierced and cusped to design.

Finish at top with 9 in. by $1\frac{1}{2}$ in. book board, tongued on, twice ovolo moulded on front edge, and finished at back edge with 2 in. by $\frac{3}{4}$ in. moulded fillet. Fix beneath projection of book board $3\frac{1}{2}$ in. by $1\frac{3}{4}$ in. bed moulding, tongued to the book board.

Supply $1\frac{1}{2}$ in. by $4\frac{1}{2}$ in. moulded plinth and surbase moulding, 4 in. by $1\frac{1}{4}$ in. let into groove.

Construe the plinth around the ends adjoining.

Fix inside the front $1\frac{1}{2}$ in. plain standards about 2 ft. apart.

Bastard Stucco. Render, float, and finish in bastard stucco, finished with a felt, float all the walls except those of heating chamber.

Cement Dado. Run around all walls, except vestries, western porches, and organ chamber, a Keene's cement dado 4 ft. 6 in. high in all, finished at top with a flush moulding 3 in. girth and 9 in. above floor, with a flush bead and quirks $1\frac{1}{2}$ in. wide in all.

Stanchions. Supply in each of the lights of eastern window on the outside 1 in. by 1 in. wrought-iron bar, set diagonally with a wrought fleur-de-lys head, the bottom of the bar let into the stone and run with lead. Put $1\frac{1}{2}$ in. by $\frac{1}{2}$ in. horizontal bars, enlarged thus (Fig. 35) for the bar to pass through and 12 in. apart, the ends let into the jambs and run with lead.

FIG. 35.

Saddle Bars. Supply to all windows $\frac{1}{2}$ in. by $\frac{1}{2}$ in. wrought-iron saddle bars about 12 in. apart, the ends let into the stone and run with cement.

In the three large foiled circles in the western window and the transept windows respectively, supply a circular ring of $\frac{5}{8}$ in. saddle bar with points welded on, let into the cusps and run with cement.

Hopper Casements. Supply and fix in such window lights as shall be directed 25 wrought-iron hopper casements, P. C. 20*s*. each, including glass, but exclusive of fixing, and fix them. Fit each casement with a set of best flax lines, 2 in. brass frame pulley, let into stone and run with cement, and a 3 in. strong brass cleat screwed to teak plugs in the wall.

Lead Lining of Stone Gutter. Line the eaves-gutter of the chancel with 7 lbs. lead, dressed over the edge of the stone and fixed with lead buttons 3 ft. apart to lead plugs in the stone, the joints of the lead to be lapped and welted and the stopped ends bossed out of the solid. The outlet to be an 18 in. length of 4 in. 8 lbs. lead drawn pipe, one end tafted and soldered to the lead of the gutter, the stone being dished to receive it, the other end for a length of 6 in. bossed out square and jointed in red lead to the iron rain-water pipe.

Gas Supplies. There shall be three separate supplies from the meter as follows :—

Fittings, how indicated. The position of the fittings is marked X thus on Plan.

Pipes. With 1 in. pipe carried along beneath the cornice of both sides of nave and $\frac{3}{4}$ in. branches carried up sides of roof trusses.

Lay on the gas to pendants (two rows).

With $\frac{3}{4}$ in. main pipe and $\frac{1}{2}$ in. branches lay on the gas to the pendants of the aisles.

With $\frac{3}{4}$ in. main pipe and $\frac{1}{2}$ in. branches lay on the gas to pulpit, reading desk, organ chamber, vestries, chancel and western porches.

Bye-pass Taps. Fit each of the two first-mentioned supplies with a brass bye-pass tap and brass regulator with indicating plate.

Fix the Fittings. Fix the fittings provided, and supply to each bracket a French polished mahogany rose.

Quarry Glazing. Glaze the windows throughout with stoutest lead quarry lights in square quarries about 3 in. by 3 in. glazed with cathedral rolled glass in varied tints with $\frac{3}{4}$ in. border of white sheet glass, fixed with stout copper wire to the saddle bars, let into grooves in the stone and pointed with cement.

Supply Attendance and Scaffold for Stained Glass Maker. The stained glass for the eastern window of chancel for which a sum is provided, see "Provisions," will be fixed by the glass painter, who will also supply his own saddle bars, but contractor shall supply scaffolding and attendance, shall cut all mortises and grooves, and shall point on both sides with cement as directed. The contractor shall supply paper patterns, templates, and dimensions to the glass painter, and shall be responsible for their accuracy.

Painting. The hinges of doors, the closing rings and latches, the heads of the ornamental nails to doors, and the exposed iron work of roofs to be finished black.

Oiling Oak. Twice oil and well rub up after each oiling the whole of the external oak work.

Heating and Ventilation.

Provision for Heating. Provide for the heating apparatus. P. C. £200.

Provision for Ventilation. Provide for external air gratings and valves for the supply of fresh air to coils and for exhaust ventilator in turret, all exclusive of fixing, £25.

Attendance on Heating Engineer. Attend upon, cut away for, and make good after hot-water engineer, for hot-water pipes and coils, and load, cart from the railway station to the building, and unload the boiler, pipes, coils, and other ironwork.

Supply Labour and Materials for Boiler Setting. Supply labourers' time in attendance on hot-water engineer's bricklayer in setting the boiler, and supply the necessary materials for setting.

Fix Exhaust Ventilator. Fix the exhaust ventilator in the turret.

Fix Ventilating Gratings. Fix the inlet gratings and valves supplied by the engineer, and form cranked flues through walls, and render them with cement.

Stone Frames to Gratings. Supply for these gratings Bath stone frames to detail.

Air Inlets. Supply fresh air to the coil chambers which do not adjoin the external walls by 9 in. drain pipes bedded and jointed with cement, with a bend at each junction with a chamber.

Channels for Pipes. Form channels for the pipes built on the concrete beneath the floors of half brick sides in cement, covered with 2 in. self-faced York stone. The concrete will form the bottom.

Flooring over Pipes to be made to Remove. Where the pipe channels pass under the boarded floors fit a width of 18 in. with screwed ledges in convenient widths for removal. Rebate the edges and those of the floor adjoining, and screw down with brass screws and cups.

Where the pipe channels pass under wood block floors reduce the blocks to 1 in. in thickness, and glue and screw them from the back to 1 in. deal, rebating the edges and those of the wood block floor adjoining, and screw down with brass screws and cups to fir bearers 4 in. by 2½ in. dovetailed section bedded in the concrete parallel to the channel.

Fronts to Coils. Form fronts to the recesses of the window backs where the coils are placed of 1½ in. by 1½ in. by ¼ in. angle iron frame with uprights about 12 in. apart, riveted together with small angle plates at angles and junctions, fixed with screws to 1½ in. by ½ in. ties 12 in. long, with fanged ends built into the wall and tapped to receive the screws, three ties to each jamb. Cover with "Jhilmil" (Hayward & Eckstein, Union Street, London) metal lathing. Finish with Keene's cement to match the dado, and the entire panel to be fitted for easy removal.

Gratings over Coils. Cut rebated holes through the stone internal sills of window, which will be 4 in. thick, and form a top to the coil chamber, &c. Fix therein a polished brass grating ½ in. thick with brass handle and slide as hit or miss arrangement.

SCHOOLS.—*See Notes, p. 554.*

In addition to the ordinary items of a contract there are certain special ones or variations of those before mentioned which may be required, as the following, based on the specifications of the School Board for London.

Conditions.

Access to the Building. Every member of the Board and their officers shall at all times have free access to the works, and the Board shall have full power to send workmen upon the premises to execute fittings and other work not included in this contract, for whose operations the contractors shall afford every reasonable facility, provided that such operations shall be carried on in such manner as shall not unnecessarily impede the progress of the works included in this contract, but the contractors shall not be responsible for any damage which may happen to or be occasioned by any such fittings or other work unless such damage be caused by, or by the neglect of his own workmen or other persons employed by him or any sub-contractor.

Contractor not to Alter Quantities. No alteration shall be made by the contractor in the text of the bills of quantities. If any alteration or addition is made by him, such alteration or addition will not be recognised, and the text of the quantities as prepared by the quantity surveyor will be rigidly adhered to.

Measurement of Variations. In adjusting extras or variations on the contract, the Board's measuring surveyor will measure on the same basis as that on which the quantities have been taken, and all labours not specifically mentioned in the quantities will be taken as if included in the prices of the various items.

Acceptance of Tender. The acceptance of a tender by the Board is subject to the consent of the Education Department, and the contract will probably not be signed for at least six weeks after such acceptance.

Amounts Paid Direct by the Board. Schedule of sums *to be included* in the contract for other tradesmen's work, who will *be paid direct* by the Board:—

£265 for ironmongery generally, excluding fixing, also for gearing to casements and ridge ventilators, also for picture rods, including fixing.

£21 for stoves in babies' room and manual training room, including fixing and materials for same.

£685 for heating apparatus, pipes, radiators, and fixing complete.

£65 for channels for heating pipes and covers.

£370 for tar paving.

£200 for gaspipes and fittings, including meters and deal enclosures for same, in schools only.

£40 for two lightning conductors, including fixing.

Surface Excavation. Dig over the entire area of site for an average depth of 9 in., and level and form surface to falls to receive hard core under tar paving, and remove all vegetable soil and any surplus soil from the site.

Hard Core. Cover the whole area of playground, also of girls' covered playground and schoolkeeper's forecourt and yard, where not otherwise described, with well rammed dry gravel, broken brick, burnt ballast or stone chippings 6 in. in thickness to the level prescribed with gentle falls to currents and to gulley traps.

After the hard core has been laid it is to be thoroughly rolled with a roller not less than half a ton in weight, after which all depressions are to be made good and the surface re-rolled and left in such a state as shall be approved by the tar-paving contractor, who shall give a certificate to the Board that the foundation is to his satisfaction.

Work Built Overhand. Build, face and point all work abutting on the property of adjoining owners overhand, and make the necessary arrangements with them for access to carry out the work in the ordinary manner.

Piers C. The piers marked C are to be entirely built, except where shown or described otherwise, of hard specially selected stocks laid in cement mortar as described.

Piers D. The piers marked D are to be faced, except otherwise shown or described, with hard pressed Staffordshire bricks, and backed with hard selected stocks aid in cement mortar as described.

Angles. All salient angles to the halls (above dados) also to the piers and chimney breasts in cloak rooms to be of gault bull-nosed bricks.

Gratings to Extraction Flues. The extraction flues shall have 9 in. by 9 in. cast-iron louvre gratings fixed on each side of flue near the top of the chimney shaft, and the shaft shall be built solid above the grating.

At the inlet to each of these flues, at ceiling level, supply 3 in. by 3 in. wrought deal frames with openings of the same area as the flue, filled in with strong galvanized wire lattice. Plant on the face of the frame next the room 2 in. by 1 in. moulded fillet.

Chambers for Stop-cocks, &c. Build two enclosures for stop-cocks and two for water meters 2 ft. 6 in. by 2 ft. in clear and of the requisite depths, with half brick sides in cement on concrete foundation 6 in. thick, and with 18 in. by 14 in. galvanized iron air-tight hinged cover with lock and key to each.

Each of the other stop-cocks on underground supplies or service pipes to be enclosed in a cast-iron box with hinged cover and loose key, supported on one-brick wall in cement on 6 in. concrete bottom, floated inside with cement.

Boundary Walls. The boundary and division walls of playgrounds to be built as shown on drawings, 7 ft. 6 in. above ground, stepped to the inclination of the ground, and ramped where necessary, with piers 18 in. by 4½ in. tumbled in as shown, built above ground, of picked stocks, the joints neatly struck, coped with 12 in. red Staffordshire saddle-back brick, throated brick on edge, coping in cement with special made blocks to match at stops, angles, and intersections.

The topmost four courses under the coping and all "tumbling in" to be set in cement.

Finish the squint angles with cut and rubbed malms.

Finish the salient angles with bull-nosed gault bricks.

Boundary Stones. Supply ten boundary stones 9 in. by 9 in. by 9 in. of hard York stone rubbed on exposed faces, with sunk letters 2 in. high, S. B. L.

Curbs under Railings. The curb to the iron railings next the streets to be 9 in. by 6 in. rubbed York, in stones not less than 3 ft. long, rounded on top and set and jointed in cement, with 1 in. by 1 in. by 4 in. slate dowel to each joint and ramped as required.

Put to each stay bar to the standards 21 in. by 13½ in. by 6 in. block to match the coping.

Scraper Gratings. At each entrance doorway on landings form a sinking 3 ft. by 2 ft. and 2 in. deep all in clear for scraper grating. To entrances at ground floor level form sinkings of a similar size with 6 in. by 6 in. tooled and rebated York curbs, mortised for scraper gratings, or 6 in. by 2½ in. where on fireproof floor. Render and trowel the bottoms of these sinkings with Portland cement.

Fit the iron scraper gratings to the sinkings.

Rubbing Stones. Build into walls on the side next playgrounds, where directed, twelve sawn rubbing stones of millstone grit, each 3 ft. long, 8 in. wide, and 3 in. thick, projecting 4 in. from the face of wall.

Hook and Catch Stones. Supply hook and catch stones for iron gates, including those to w.c.'s, 9 in. by 9 in. by 9 in., and let in hooks and catches and run with lead, the foot stones to those of w.c.'s being rebated as required for the stone thresholds.

Urinal. Fit the boys' urinal with ¾ in. rubbed back and ends in one length to each compartment and end bedded in cement against the brickwork and screwed with 3 in. copper screws, the heads countersunk to oak plugs in the brickwork, four screws to the back of each compartment and to each end. The divisions to be 18 in. wide of 1¼ in. slate rubbed both sides let into the paving 2 in. and the edges of the backs to each compartment rebated to receive them. The whole to be jointed with oil mastic cement. The exposed edges to be filed, rounded and rubbed with small quadrant corners, the total height of the slabs to be 5 ft. 6 in.

Lay for the whole length of the urinal range and falling towards the channel 1¼ in. rubbed slab with rubbed edges. Bed in the concrete to falls Broad's 6 in. white enamelled channel blocks with solid ends, with 6 in. outlet and 6 in. heavy brass grating all bedded and jointed in cement.

Fit the master's urinal in similar slate and all as last, but the exposed parts of the slate divisions, backs and ends to be enamelled ivory white in the best manner.

The floor joists where they rest upon girders to be fixed to break joint over same.

Wood Slips. Supply on top of each rolled iron or steel joist to wood

floors $\frac{3}{4}$ in. deal slips 1 in. less in width than the flange of joist to form key for plaster of ceiling.

Ventilating Ridge. Form ventilating ridge to the manual training centre with fir filleted curbs the sizes shown on detail, the curbs blocked apart with 2 in. cut and shaped deal blocks fixed not more than 3 ft. centres to receive the zinc capping to form split ridge for ventilation, and supply 1 in. deal clamped flaps to each bay hung in centres and fitted with gearing for opening and closing.

Roofs to Out offices. The roofs over the children's w.c. in playground to be framed with plates, rafters, &c., as shown on drawings, and with $2\frac{1}{4}$ in. chamfered fixed skylight put together in white lead and with bars 2 in. and $4\frac{1}{2}$ in. wide alternately with horns at top 8 in. long, the skylight to have a fall of not less than 3 in. in the foot, the bottom rail to be 3 in. wide and bedded in white lead fixed to 4 in. by 4 in. splayed plate forming the head of door frames to project $3\frac{1}{2}$ in. from the face of the frame and to be throated.

The stiles and $4\frac{1}{2}$ in. bars at top of skylight are to project and to be pinned $4\frac{1}{2}$ in. into the wall leaving a clear space of 3 in. between skylight and wall, over this space fix 7 in. by 1 in. wrought cover board on wrought and cut bearers, fixed 3 in. above skylight and covered with No. 16 gauge Vieille Montagne zinc with $\frac{3}{4}$ in. bead worked on the lower edge and the upper edge turned 3 in. up wall with cover flashing 6 in. wide.

Cover the sides of skylights with similar zinc one side turned 3 in. up the wall the other edge dressed on to the glass, put stepped cover flashing to same.

Fix up rakes to the underside of the skylight $1\frac{1}{2}$ in. by 1 in. chamfered fillet scribed to the wall.

Ironmongery. A provision will be found for all bolts, locks, latches, casement quadrants, stay-hooks, sash fastenings and lifts, fanlight catches, centres for doors, door springs, door furniture, chains, sash centres, cloak pegs, ball catches, casement fastenings, dresser hooks, screw knobs and flush rings, door stops and check springs, door knockers, skylight quadrants, hard wood knobs for drawers, bow handles, all brass and other screws for fixing ironmongery, picture rods, and casement gearing.

The contractor to fix all the above ironmongery except

the picture rods and the casement gearing. He is also to supply cut and moulded wooden brackets for the gearing.

Contractor Responsible. The contractor will be held responsible for the ironmongery delivered upon the works by the Boards' ironmonger, for which he will be required to give a receipt, and such ironmongery only as is fixed will be paid for by the Board.

Other Ironmongery. The remaining ironmongery to be supplied by the contractor to be of the best quality, equal to specimens, to be seen at the offices of the Board, and to be submitted to the inspection of the architect or clerk of works before being used. All the iron butts are to be wrought, and to be of the quality known as the best broad double-joint hinges. All brass work is to be fixed with brass screws.

Floors. The floors of halls, drawing-class room, babies' room, babies' room class-rooms on ground floor, also class-rooms of laundry, and manual training centre and stores to be of clean pitch pine strips 3 in. square 18 in. long dipped in hot Stockholm tar, and laid with close joints herring-bone fashion, with narrow border at edge, the face to be planed off and to have a coating of boiled oil at completion. The strip floors to run under the raised platforms only sufficiently to form a good bearing for the feet of the fir bearers, and the wood block floor in the drawing-class room is not to be continued beyond the ashlaring of roof.

The whole of the pitch pine strips to be delivered on the site of the schools before the first certificate on account of the works is granted, and shall be stacked so that the air may pass freely between the strips. These floors are not to be laid until the concrete and cement under them are perfectly dry, and the laying of these floors may be delayed till after the completion of the building if necessary to ensure the proper execution of this clause.

If the joints of these floors open $\frac{1}{32}$nd part of an inch the whole of the floor of the apartment in which it occurs shall be taken up and relaid.

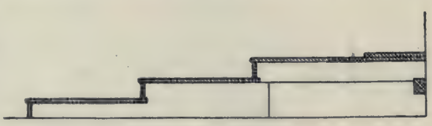


FIG. 36.

Platforms for Desks. The platforms for desks (Fig. 36) in all class-rooms where shown to be formed with $1\frac{1}{4}$ in. flooring, tongued together with rounded nosings and 1 in. wrought

Platforms for Desks.

and tongued risers, and to be supported on bearers as drawing, and plates $4\frac{1}{2}$ in. by 3 in. Each step of the platforms to graded school to rise 5 in., the back one next wall to be 3 ft. 4 in. wide and the other 2 ft. 4 in. wide each to the infants, each to rise 4 in., and to be for the senior infants 3 ft. 4 in. wide at back and 2 ft. 4 in. for the others, for the junior infants 3 ft. wide at back and 2 ft. for the others, as shown on the detail drawings.

Put on top tread against walls 12 in. by $1\frac{1}{2}$ in. wrought

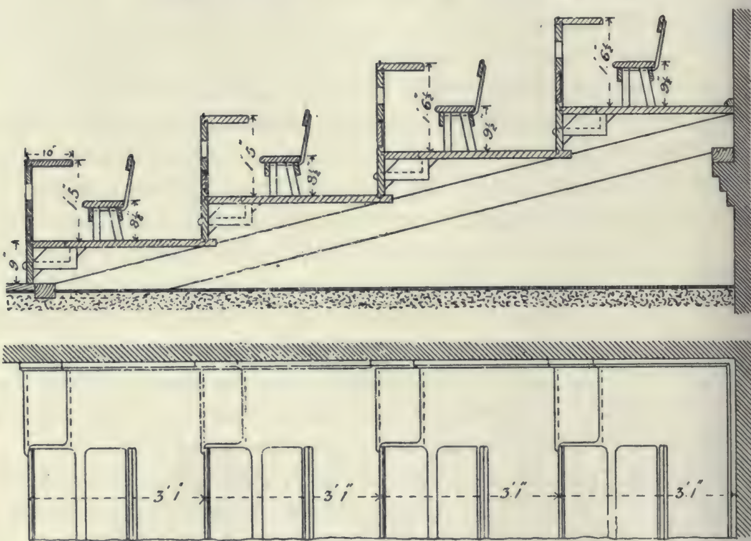


FIG. 37.

one side boarding as required, chamfered on one edge and fixed on floor.

The platforms in laundry and manual training centres will be similarly constructed with risers and treads the sizes shown on the detail drawings. The platform in laundry centre to be enclosed at end with $1\frac{1}{4}$ in. wrought deal with returned rounded nosings to treads.

Kindergarten Gallery.

The floor and gangways of kindergarten gallery in babies' room (Fig. 37) to be supported on 7 in. by 3 in. raking joists, notched at top to receive $4\frac{1}{2}$ in. by 3 in. wall plates and ends of treads and splayed at bottom, the wall plates to be supported as shown, to be constructed with $1\frac{1}{2}$ in. treads on 2 in. brackets.

Kindergarten Gallery. Form gangways as shown with 1 in. risers tongued in, the fronts to have $1\frac{1}{2}$ in. bead flush and square framing, the upper panels open, $1\frac{1}{4}$ in. cross-tongued top with bead tongued in front of same, to be supported by $1\frac{1}{2}$ in. by $\frac{1}{2}$ in. stays of wrought-iron, let in and fixed flush. The seats to be $1\frac{1}{4}$ in. wrought and rounded with $2\frac{3}{4}$ in. by $\frac{3}{4}$ in. fillets

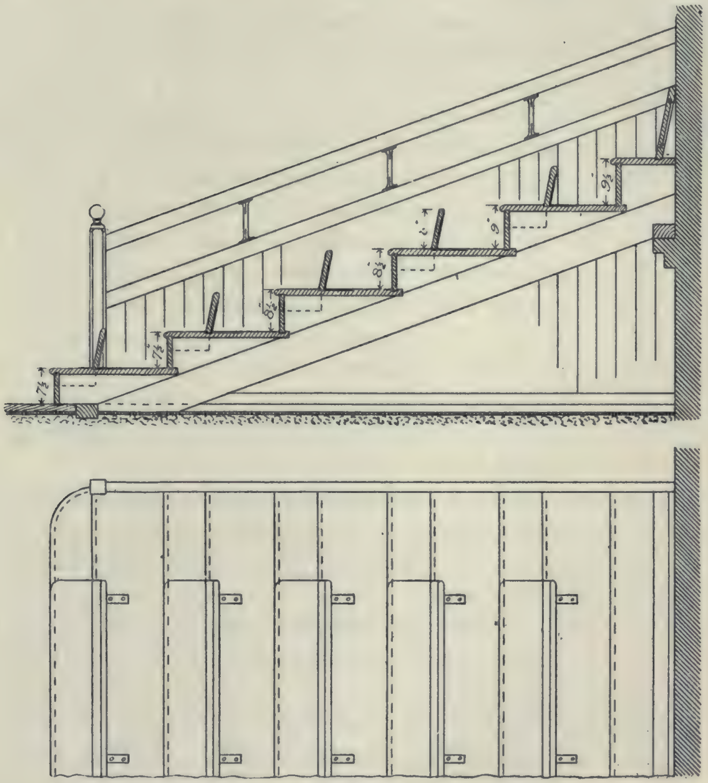


FIG. 38.

under, with cut ends, and with $3\frac{1}{4}$ in. by $1\frac{1}{2}$ in. wrought and rounded back rail, supported on cast-iron standards, the brackets under seats to be framed as shown of 2 in. by $1\frac{1}{2}$ in. deal as detail drawings.

Give notice to the architect before the platforms and gallery are proceeded with, so that the correct sizes and positions can be given to the contractor.

Infants' Gallery. Construct the infants' gallery to detail (Fig. 38) with 7 in. by $2\frac{1}{2}$ in. raking joists and $4\frac{1}{2}$ in. by 3 in. plates. Fix to the backs of the joists $2\frac{1}{4}$ in. deal gusset pieces, and lay thereon $1\frac{1}{4}$ in. treads with rounded nosings and 1 in. risers, all rebated and grooved together and glued and blocked. Notch the treads at each end of the gallery, and insert risers to form intermediate steps.

The back of topmost seat shall be 16 in. wide of $1\frac{1}{4}$ in. bead flush framing 1 panel high, the upper edge rounded, the lower let into floor. The other seat backs shall be 8 in. by $1\frac{1}{4}$ in., the upper edge rounded the lower let into floor. Support these backs by $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. wrought-iron knees 12 in. girth fixed with four screws with countersunk heads. The part of the knee on the floor shall be let in flush.

Construct the ends of $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in. four times chamfered newels with turned ends as ball finials, 3 in. by $2\frac{1}{2}$ in. rounded top rail supported by wrought-iron standards, weight $2\frac{1}{2}$ lbs. each, 3 in. by 2 in. intermediate rail, rebated and twice chamfered. Fill in the ends with 1 in. wrought, both sides grooved, tongued and beaded both sides, boarding in 4 in. widths, with 2 in. by 2 in. chamfered fillet on the inside nailed to floor.

Form in the boarding of each end a ledged door 2 ft. wide hung with 12 in. strong cross-garnets. Fit with 5 in. iron rim dead lock, $1\frac{1}{4}$ in. brass screw knob, and $1\frac{1}{2}$ in. by 1 in. beaded stop.

All the salient angles of seats and their backs shall have small quadrant corners, and every exposed edge shall be rounded.

Windows. The windows of halls, class rooms (including those in laundry and manual training centres, also in stock room and teachers' rooms) to be fitted with 2 in. moulded sashes, with moulded sash bars and horns in cased frames, the number of lights shown and with segmental heads where indicated of 1 in. inside and 1 in. moulded outside linings, $1\frac{1}{4}$ in. pulley stiles and proper parting slips $\frac{5}{8}$ in. back linings and segmental heads where shown, all properly tongued and grooved together and framed to teak sills 8 in. by 3 in., sunk weathered, throated, and check-throated. The sashes to be double hung, and including brass bushed axle pulleys, strong patent flax lines and purpose cast-iron

Windows. weights, except to the centre mullions, which are to have special cast lead weights with brass pulleys cast in tops of same. The sash beads are to be fastened with round-headed tinned screws spaced out 3 in. from each corner, and not more than 15 in. apart elsewhere.

Put brass sash fastenings on all double-hung windows within reach, and on all double-hung sashes out of reach brass flush eyes on plates for long arms, and to each lower sash two sash lifts. Those on ground floor to have spring catches.

The upper part of these windows where shown to be hung on brass sash centres or hung to fall in and to be fitted with approved gearing for opening and closing, included in provision for same. Put solid teak transomes and fir heads, &c., where shown, all to detail drawings.

All frames to have deal moulded fillets mitred around outside and scribed to the brickwork to cover joints as detail drawing.

All frames in plastered rooms to be properly grooved on the inside for linings or plaster, and all teak sills to be coated on the under side with tar.

Casements made to open. All casements made to open as shown by detail drawings. Where hinged outside to have 3 in. brass butts, and where hung at bottom in cloak rooms, lavatories, staircases, halls and class rooms where shown to be provided with approved special brass stubs and plates with approved casement quadrants and brass spring knob fastening, those hung at side for cleaning to have dog-cart latches.

All windows fitted with shad bolts and fanlight catches. Where not sufficient room to get at screw of shad bolts to be hung with stubs and plates, or to have plate of shad bolts fixed so as to be easily accessible.

Moulded Fillet. Put moulded fillet 6 in. by $2\frac{3}{4}$ in. to sills of all halls and class room windows, hollowed at back as detail, to form fresh air inlet, and 4 in. by $\frac{3}{4}$ in. lining with moulding on top edge to sill of teachers and schoolkeeper's windows.

Doors. The external entrances to schools to have $4\frac{1}{2}$ in. by $3\frac{1}{2}$ in. fir dowelled moulded and chamfered frames, and the doors to be $2\frac{1}{4}$ in. framed into panels (the bottom panels flush outside) with moulded and chamfered framed muntins stop moulded with stops as detailed drawing, the top panels open

and glazed with $\frac{1}{4}$ in. rough plate glass, the doors hung folding in two leaves, the large leaf to be hung with centres top and bottom so as to open both ways, the small leaf with 4 in. iron butts, the small door to have two 10 in. bright rod barrel bolts, the large door to have 8 in. roller bolt lock with brass knob, and a $2\frac{1}{4}$ in. brass bronze octagon door knob on outside. Cover the joint of frame on inside with architrave moulding 2 in. by $\frac{3}{4}$ in.

On outside of these doors at bottom put pieces of $\frac{3}{16}$ths. in. sheet iron of the height shown, securely fixed with 1 in. screws and countersunk holes. Put a strong stay hook with eye and plate to keep each door open.

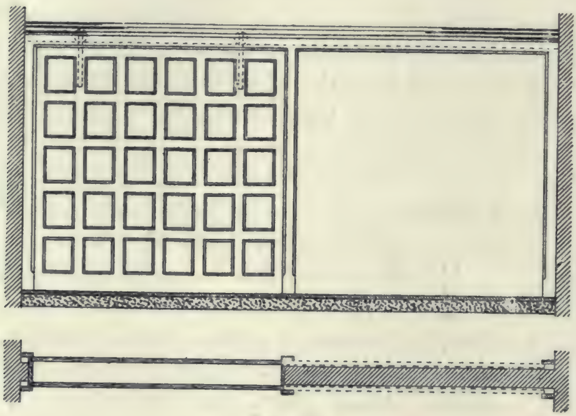


FIG. 39.

Sliding Partitions.

Construct the sliding partitions between classrooms 1 and 2 to detail (Fig. 39). The lintel shall be of fir 9 in. by 12 in. sawn and reversed with $\frac{1}{2}$ in. rolled iron flitch bolted with $\frac{1}{2}$ in. bolts about 18 in. apart, the heads and nuts let in flush. Line with 1 in. beaded lining. The fascia and pilasters on each face of the wall shall be 2 in. wrought all around and stop moulded on all arrises. The cornices shall be of two pieces $2\frac{1}{4}$ in. by 4 in. and $6\frac{1}{2}$ in. by $2\frac{3}{4}$ in. respectively, rebated and tongued together, glued and blocked, and with 1 in. cover board. Fix to each face of the lintel $2\frac{3}{4}$ in. by 3 in. rough fillet. Each sliding partition shall be $2\frac{1}{4}$ in. thirty panels moulded and flush framed, hung on two

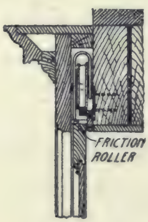


FIG 39A.

polished gun-metal wheels 6 in. diameter with stout axles, and 2 in. by $\frac{1}{2}$ in. wrought-iron straps, each screwed to the door with four 2 in. stout screws with countersunk heads. The bearings of the axles shall be steel-bushed. The running rail shall be of wrought-iron of the section shown on the drawing, screwed with stout screws with countersunk heads to the lintel, and the back flange let in flush to the lintel. Fix in the face of each top rail 6 brass friction rollers, three inside and three outside. Supply for each leaf four 3 in. brass flush sash lifts, two inside and two outside.

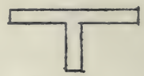


FIG. 40.

Screw to the bottom of each partition a 2 in. by 1 in. rail of $\frac{3}{8}$ in. wrought-iron as sketch (Fig. 40), the heads of the screws countersunk. Let into the floor a 2 in. by $\frac{3}{4}$ in. gun-metal plate, grooved as sketch (Fig. 41) securely screwed.

FIG. 41.

Partitions in Cloak-rooms.

The internal partitions in cloak room to be formed with 4 in. by 4 in. posts, rounded on external edges and fixed, except where otherwise shown, with iron dowels at feet. The posts to run up to the ceiling in all cases and framed into 4 in. by 4 in. twice rounded heads, except under teachers' rooms, in which case they are to be 7 in. by 4 in. The hat and cloak rails three in height to be 4 in. by 2 in. wrought and framed at ends into posts.

The divisions between cloak rooms to have 4 in. by 4 in. posts and heads, 4 in. by $2\frac{1}{2}$ in. sill, and 4 in. by 4 in. transome rail fixed 4 ft. 6 in. in infants' and 5 ft. in girls' and boys' departments from floor level, all to have rounded edges as necessary. The divisions to be boarded up solid with 1 in. matched and V-jointed boarding to the height of the underside of the transome, the boarding being fixed with shifting beads mitred round and secured to the framing, the upper part above transome to be filled in with stout galvanized wire-work of special pattern. The sill and head to be secured where necessary to iron or steel girder with 3 in. screws about 18 in. apart.

W.C. Divisions.

The divisions between the children's w.c. (Fig. 42) to be formed with 1 in. matched beaded both sides and ledged batten boarding cut raking at top and housed into 3 in. by 2 in. grooved capping and into 3 in. by 2 in. double chamfered

W.C. Divisions.

and grooved rail at bottom, and let into the front uprights, grooved as shown for the purpose. The rail and capping are to be framed at ends to uprights and cut and pinned into the brickwork. Each w.c. to have $1\frac{1}{2}$ in. four plane bead flush and square door 5 ft. 8 in. high (the bottom 4 in. above the floor) and hung by 15 in. cross garnets to 4 in. by 3 in. rebated and double-beaded posts, the posts framed into the head carrying the skylight, and to have iron dowels let into 3 in. York templates at feet. Put 4 ft. by

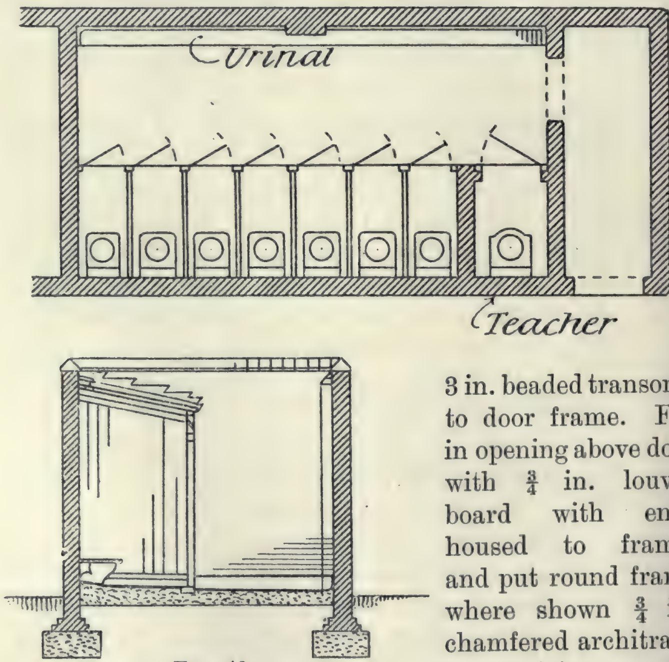


Fig. 42.

3 in. beaded transome to door frame. Fill in opening above door with $\frac{3}{4}$ in. louvre board with ends housed to frame, and put round frame where shown $\frac{3}{4}$ in. chamfered architrave to stop joint.

The doors to have 4 in. japanned wrought-iron bow handles and Weston's steel wire door spring. Each door to have a piece of stout galvanized iron chain 18 in. long securely riveted to plates at each end to prevent them falling back. No fastenings will be required to children's w.c. doors.

The teachers' external w.c. doors to be $1\frac{1}{2}$ in. four panel bead flush and square hung with pair of 3 in. iron butts to 4 in. by 3 in. rebated and beaded frames, and to have 4 in japanned night latches, each with three keys. The doors to

flushing tank compartments to be similar, but secured with dog-cart latches.

W.C. Seats, &c. The w.c. to be fitted up with $1\frac{1}{4}$ in. clean deal seats and 1 in. risers on strong bearers, the seats rounded on edges and formed as clamped flaps and beaded frames, and every seat hung with 3 in. brass butts and fitted with a dog-cart latch.

The seats to the teachers' and schoolkeeper's w.c. are included with the pedestal apparatus. The whole of the seats and risers to be made to remove. The risers to be 12 in. high for infants and 15 in. high for boys and girls. Cut all necessary holes in seats. Leave spaces 3 in. high at bottom of risers to all children's w.c's so that they may be cleaned out. The holes for children's w.c.'s to be 7 in. wide and 10 in. long, and $4\frac{1}{2}$ in. from front of riser.

Seats in Playground. Supply 2 in. by 12 in. deal seats under covered playgrounds, as shown on drawings, wrought all round and cross-tongued, with rounded edges to front of same, and supported on bearers of 3 in. by 3 in. by $\frac{3}{16}$ths rolled tee iron about 2 ft. long and 2 ft. 6 in. apart, one end caulked and cut and pinned into wall, and the other end rounded, all fixed to the undersides of seats, with three screws to each in countersunk holes.

Rails and Pegs. Supply where directed on walls in cloak rooms, including laundry and manual training centres, deal double-beaded rails, 4 in. by 1 in., screwed to the boarding or plugged to walls as required, for which provide 754 ft. run and fix No. 1334 strong wrought-iron japanned double pegs of the school board pattern, not less than one foot apart according to the space at disposal. No rail to be fixed more than 6 ft. high.

Supply where directed in the teachers' rooms deal double-beaded rails 4 in. by 1 in., average 8 ft. long, plugged to walls as required, and fix in each room six hat and cloak pegs (included in provision for ironmongery).

Supply to laundry class room where directed No. 2 $4\frac{1}{2}$ in. by 1 in. deal wrought rails, moulded all round as shown on detail, 3 ft. 6 in. long, with No. 6 brass wardrobe hooks to each (included in provision for ironmongery), stained and varnished.

Supply in addition to the above 20 ft. run of rail o.

similar description, and No. 30 (fixing only) brass wardrobe hooks.

Picture Rails Provide two 5 in. by $1\frac{1}{2}$ in. double-beaded rails round walls of drawing class rooms at heights to be directed (200 ft. run as provision).

Shelves. Provide 100 ft. run of 11 in. by 1 in. deal shelves on cut wood brackets in school keeper's house, &c., as directed and fix same.

Put three tiers of 1 in. by 11 in. cross-tongued shelves and standards in each stock room in school building and manual training centre. For this purpose provide 200 ft. run in school building, and 60 ft. run in manual training centre.

Slate Backs to Lavatory Ranges, &c. Supply $\frac{3}{4}$ in. rubbed slate skirting to the back and ends of all children's lavatory ranges, and also to the slop sinks 12 in. high, secured with brass screws, having countersunk heads, and plugged to brickwork; where skirtings are fixed to partitions allow for blocking out panels as may be required.

Give Notice. The contractor shall take dimensions for all iron and steel work from the actual work before putting the same in hand, and shall be held responsible for the accuracy of all fitting and fixing of same.

The iron and steel work to be carried out in such order as the architect shall direct.

Entrance Gates. Supply wrought-iron ornamental gates to the entrances, with stone dressings in the boundary wall $1\frac{1}{4}$ in. by $1\frac{1}{4}$ in. hanging and locking stiles, $\frac{5}{8}$ in. by $\frac{5}{8}$ in. centre bars, $2\frac{1}{2}$ in. by $\frac{1}{2}$ in. top and bottom rails, 2 in. by $\frac{3}{8}$ in. lock rails made to detail drawings, and hung complete, and fitted with oak stumps and iron ball catches for holding same open. The gates to be hung folding where shown.

Gates to Outer W.C.'s. Supply wrought-iron gates 6 ft. 6 in. by 3 ft. to the openings of w.c. buildings, with $1\frac{1}{8}$ in. by $1\frac{1}{8}$ in. hanging stile, $1\frac{1}{8}$ in. by $\frac{1}{2}$ in. locking stile, 2 in. by $\frac{3}{8}$ in. lock rails and braces, 2 in. by $\frac{5}{16}$ in. top rails, $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. bottom rails, and $\frac{3}{4}$ in. by $\frac{3}{4}$ in. bars, all made to detail drawing, with locks, and hung complete.

The laundry copper and ironing stove are not included in this contract, but the contractor must

include for fixing same and supplying the necessary 3 in. cast-iron flue pipes with all purpose made bends, having soot doors in same, and with all sheet-iron plates, dampers, &c., necessary for the purpose.

School Bell. Supply and hang where directed, to ring from ground floor, a school bell 18 in. diameter, to be procured from Messrs. Warner, Mr. A. Lawson (late Mears & Stainbank), Messrs. Lewis & Co., Shepherds Lane, Brixton, Messrs. Tayler & Son, Loughborough, or Messrs. Gillet, Bland & Co., to be of good tone, with all necessary fittings and gear with $\frac{3}{4}$ in. welded link strong galvanized iron chain complete, and also a strong wrought-iron cage properly fixed to walls. Provide for attending upon, cutting away for and making good after bellhanger in all trades the sum of £2 10*s*.

School-keeper's Bell. Supply a 36 oz. deep-toned bell with stout well-stretched copper wires in concealed tubes, with all necessary cranks, carriages, &c., and approved bronzed quadrant, countersunk pull, fixed at principal entrance to ring where directed near schoolkeeper's house, the wire to be enclosed where it crosses playground, in 1 in. galvanized iron tube. Attend upon, cut away for, and make good after bellhanger in all trades.

Wirework. Supply approved strong galvanized $\frac{1}{2}$ in. mesh straight wirework for skylight of w.c.'s in playgrounds, fixed 3 in. above glass on $1\frac{1}{4}$ in. by $\frac{3}{16}$ in. galvanized wrought-iron bars 14 in. apart, with ends twisted and holed for screws, and with holes for $\frac{3}{8}$ in. crossbars as shown on detail. Supply galvanized $\frac{1}{2}$ in. mesh straight wire work, No. 8 wire gauge frame, No. 10 wire gauge ribs or crossbars, and No. 12 wire gauge uprights, the ribs to be 4 in. apart, as will be directed to the borrowed lights from landings and stock rooms to corridors, also to two bays of glazed partition next Kindergarten gallery, and to those windows to lavatories, &c., under the entrance steps, all to be hinged at side and fastened with padlocks (as will be furnished), for cleaning glass. Supply similar wire netting behind louvre gables in class-room roof.

Umbrella Stand. Fit up in each of the cloak rooms, including laundry centre, where directed, 1 in. gas pipe rail 6 in. from wall for umbrellas, witn brackets to same as required.

Covered Playground. The covered playground to be executed according to detail drawings, the roof formed with rolled steel joists T iron rafters and struts, and wrought-iron tie rods. The flat apex to have gusset plates each side riveted to principals, the principals to have angle irons riveted to them to secure the fir purlins, and filleted curbs to form split ridge for ventilation. The fir hips, where same occur, to be secured as shown on detail.

Children's W.C. Fittings, &c. The children's w.c.'s to be fitted with approved enamelled (not salt-glazed) stoneware w.c. troughs, properly set in concrete, and having nozzle inlet at one end and outlet with P-trap of similar description at the other. The flushing chamber or tank at side of same to be self-acting, those with five seats to hold 60 gallons, and with six or seven seats to hold 80 gallons, all fitted with annular syphons, and connected with the trough by 4 in. iron pipes. Build brick piers, and provide proper strong iron brackets or bearers to carry the tanks. Supply 5 lbs. lead aprons under all w.c. seats.

Other W.C. Apparatus. Fit up the teachers' and schoolkeeper's w.c. with Doulton's improved "Simplicitas" plain stoneware wash-down closets and traps, with pine seats and 4 gallon water-waste preventers, with galvanized iron chains and pull down handles, fixed. Connect the water-waste preventers with the apparatus by means of $1\frac{1}{4}$ in. lead service pipes.

Lavatory Fittings. Supply, where shown on plans, ranges of Harris's fixed lavatory basins with plugs, slate tops, iron bearers, supply valves, and brass fittings complete, in all respects equal to the sample to be seen in architect's office, with $1\frac{1}{2}$ in. lead waste pipes, branched at each basin into a 3 in. nearly horizontal main cast-iron waste, fitted at lowest end with a 3 in. lead anti-D trap, with a 2 in. brass screw cap and lining soldered into the side of trap, and fitted at the higher end of the 3 in. pipe with a 3 in. galvanized iron screw cap; the 3 in. waste pipe is to be continued from outgoing of trap with a brass thimble through the external wall, and to discharge either on to a gully trap or branched into a 3 in. vertical galvanized iron waste pipe fixed for the purpose to receive it on outside face of the external wall, the bottom of same to discharge as shown, the top to

be carried up as shown, and finished with a copper wire globular cover.

Provide and fix in each teacher's room a Harris's approved lavatory basin with slate top and skirting (as sample in architect's department), lay on water with ½ in. lead pipe, and put 2 in. lead trap and waste to discharge into the rain-water pipes, which are to have branch pieces thereon, and brass thimble connections from same to lead waste.

Slop Sinks. Supply where shown on drawings (one to each department, and in every case on the main floor levels) a patent cast-iron enamelled slop sink 9 in. deep, with slate top and patent plug stopper with grated washer, all strictly in accordance with the samples to be seen in the architect's office. Supply lead traps, and take 2 in. lead waste pipes from the sinks on the upper floors to discharge into the heads of rain pipe, the joints of this pipe to be caulked with tow and red lead cement, and on the ground floor the waste is to discharge on to a gully as directed.

Wastes from Floor Channels. Supply to channels in floor under umbrellas and lavatory ranges brass gratings, and light lead waste pipes leading through the wall to discharge, as directed, with hinged capped ends, or connected to traps of lavatory ranges and slop sinks as shown.

Stop Cocks. All stop cocks fixed within reach of the children to have movable keys or spanners.

Put a stop cock in each branch supply.

Drinking Fountains. Supply No. 3 drinking fountains similar to one deposited at the architect's office, with 1¼ in. rubbed Bangor slate, backs 2ft. 3 in. by 3 ft. 9 in., with moulded edges and rounded corners, fixed with 4 in. strong brass screws to wood blocks cut and wedged into wall. Supply a ⅜ in. patent self-closing valve tap, fixed to slate back with brass screws, and two No. 12 wire gauge zinc drinking cups, fixed to each slate slab with strong galvanized iron chains and eyes. Supply to each a 4 in. York stone fountain base, 3 ft. 6 in. by 2 ft. 6 in., dished and tooled, rebated for 1¼ in. slate back, and perforated for and including 9 in. square galvanized iron hinged locking gulley gratings and

galvanized iron hook; also supply one $\frac{1}{2}$ in. stop-cock with guard and portable key, and one $\frac{3}{4}$ in. air chamber 8 in. long, soldered into a $\frac{3}{4}$ in. lead branch supply pipe at the back of fountain slab.

The supply for drinking fountains to be taken direct from the main in cases where a "constant" supply is available.

Copper Clips. Each square in the skylights to have two 4 in. by $\frac{1}{2}$ in. by $\frac{1}{16}$ in. copper clips screwed with brass screws to the bottom rails.

Quarter Inch Rough Plate. Glaze with $\frac{1}{4}$ in. rough plate glass all skylights, and the upper panels of door and sidelight to boiler room; also of all entrance doors and side windows to same; also the windows to the infants' lavatories, and store under steps in basement.

Fluted Rolled Plate. Glaze with Hartley's $\frac{1}{4}$ in. large pattern fluted rolled plate the framings between corridors and mezzanines; also the door and sidelights of screen to boys' stockroom on first floor mezzanine.

Ground Sheet Glass. Glaze with 21 oz. ground one side sheet the lower squares of glass in all windows to height not exceeding 6 ft. above the ground, where they abut upon the streets or the playgrounds of another department; also the lower panes of the temporary corridor windows overlooking the playgrounds of another department, the lower panes of class-room windows on the upper floors adjacent to the desks, including the lower squares of the borrowed lights between class-rooms and halls and corridors, also those in the sidelights to the class-room doors, and the lower squares in glazed partitions between class-rooms except to doors in latter, which will be glazed with clear glass, similar to the other class-room doors, and also the upper panels of communication doors, and the lower squares in windows to the laundry and manual training centres.

Gaspipes, &c The exposed gaspipes for a length of 600 yards are to be painted four times. Paint the standards and waste pipes of lavatory ranges, also the picture rods, brackets, hooks, &c., for a length of 500 yards, and No. 480 holdfast brackets and roses to same, two coats after fixing. Paint the gearing to windows, &c., one coat before fixing and two coats after fixing it.

Varnishing. All the outside faces to external doors of entrances to have in addition two coats of good varnish.

Compass Points. On ceiling of each class-room, as will be directed, securely and correctly stencil an ornamental compass point 5 ft. 10 in. by 3 ft. 4 in. over all, with the four cardinal letters $4\frac{1}{2}$ in. high, the pattern to be approved by the architect.

WAREHOUSES AND MANUFACTORIES.

In addition to the ordinary items of a contract there are certain special ones or variations of those before mentioned which may be required, as the following:—

Digging under Pavings. To secure a hard surface for the paving the general excavation shall only be made at first as far as the floor level of the basement. When the work is ready to receive the basement paving the further digging necessary to admit the concrete shall be done.

Extra Digging and Concrete. Should any part of the bottoms of the trenches be found soft, it shall be excavated to a sound bottom and filled up with cement concrete. Such extra concrete and digging shall be measured and allowed for at the rates of the original contract.

Concrete Floors and Pavings. The men employed on the floors shall be such as are accustomed to this kind of work, but if the architect is not satisfied that contractor has proper facilities and men for doing this work, and the paving thereon, he shall employ a specialist to be approved by the architect.

Basement. Lay the whole area of basement floor with concrete 6 in. thick composed of 4 parts Thames ballast, 1 part clean washed sand, and 1 part of cement wetted through a rose with no more water than is necessary. Float the surface 1 in. thick with a mixture of 3 parts of washed sand and 1 part of Portland cement.

The concrete for the upper floors to be composed of hard burnt broken brick scoria or granite chips, no piece larger than 1¼ in. each way, all of irregular shape and quite clean, mixed with granite dust and clean washed sharp sand, to make a mass free of interstices, before adding the cement. Add 1 part of Portland cement to 4 parts of the foregoing mixture, thoroughly mix with just sufficient water, fill in as soon as mixed, and well ram, the broken bricks to be wetted before mixing.

Basement. All edges or unfinished surfaces left for a time and intended to be continued or covered with cement shall be protected from dust and kept clean.

All concrete of floors exposed to a hot sun shall be covered with wet sacks until completely set.

Lay across the steel binders of the floors 1 in. by 1 in. by $\frac{1}{8}$ in. L iron 12 in. apart, thus V, in as long ordinary lengths as obtainable, the joints lapped and riveted with two $\frac{3}{8}$ in. rivets. The angle iron shall not be allowed to rust, shall be scraped free of scale, and brushed over before laying with liquid Portland cement. The concrete of these floors shall be 6 in. thick, and the L iron embedded in and kept 2 in. from the soffit of the concrete.

Cover the concrete of each floor, except the basement, with paving floated and trowelled 1 in. thick of a mixture of $2\frac{1}{2}$ parts of small granite chips, average size $\frac{1}{2}$ in. by $\frac{1}{4}$ in., 2 of smaller chips, and $\frac{1}{2}$ part granite dust, and 1 of Portland cement, the surface floated and trowelled in the same operation with a mixture of 2 parts of granite dust to 1 of Portland cement.

The whole of the foregoing materials to be kept quite clean, the proportions accurately gauged, and the materials thoroughly mixed in small quantities at a time.

Envelop the exposed parts of the girders and binders of the floors with galvanized iron wire netting of No. 20 B. W. G. wire securely attached, and case them with cement concrete as described for floors, and render, float, and trowel with Portland cement to the sizes shown by the detail drawings.

Supply $\frac{1}{2}$ in. by 7 in. expansion boards, and lay them all around the walls, where concrete floors are used. Before filling in the concrete remove them as soon as the concrete is set, and one month afterwards fill in the groove with a mixture of 1 of Portland cement to 2 of washed sand.

Asphalte. The whole of the asphalte to be mastic of the best quality, supplied by the Limmer Asphalte Paving Company (85, Gracechurch Street, London), and laid by their own workmen.

Lay over all walls a damp-proof course of asphalte $\frac{1}{2}$ in. thick on a Portland cement floated face $\frac{3}{4}$ in. thick, as described for basement floor.

Asphalte. Cover the outside of all basement walls where earth comes against them with asphalte $\frac{3}{4}$ in. thick, commencing with the damp-proof course, and carry up to 6 in. above the general ground level, the upper edge to be splayed.

Lay over the whole area of basement asphalte 1 in. thick, trowelled and sanded smooth with angle fillet all around at the base of walls, piers, and stanchions.

The joints of the brickwork intended to be rendered with asphalte shall be kept back as the work proceeds. The architect shall be consulted as to whether or not the walls are dry enough for its application, and he shall decide as to when it shall be done.

Stock Facings. The bricks for the stock brick facings to be picked stocks, well burnt, sound, square, uniform and bright in colour, "picked" to mean a description of brick selected at the brickmaker's yard, and sold as "picked stocks," not merely selected by the builder from the ordinary walling bricks.

Chases, &c., for Concrete. Where the concrete of the floors abuts upon walls it shall be supported by the insets, but where none occur, it shall be supported by two oversailing courses, each of 1 in. projection.

Grooves in Brickwork. Form grooves for the iron sashes in the brick jambs, and build them in and grout them with cement.

Loophole Frames and Doors. Fit the loopholes (Fig. 43) with 2 in. framed and braced doors filled in with 1 in. ploughed, tongued, and beaded both sides boarding in 4 in. widths, hung folding with three pairs of 4 in. iron butts to 9 in. by 5 in. rebated and twice-beaded frames, put together with white lead continuous from ground floor to top of uppermost opening. Scarf the frame, but only when absolutely necessary, and screw it with stout screws. Fix the frame to the brickwork by wrought-iron cramps about 2 ft. apart, $\frac{3}{4}$ in. by $1\frac{1}{2}$ in. and 15 in. long, one end caulked and built into wall, the other end tapped and screwed to frame with stout screws, the heads let in and covered. Fit each pair of doors with two 24 in. wrought-iron monkey-tail bolts and two 12 in. Tower bolts.

Frame below each floor level two 9 in. by 5 in. transomes twice rebated and four times beaded, and about 2 ft. apart, and fill in the spaces thus formed with 2 in. one panel bead

Loophole Frames and Doors.

flush frame, filled in with 1 in. matched and beaded boarding in 4 in. widths.

Frame at each floor level 9 in. by 4 in. oak, wrought, rounded, and rebated sill; hang to these sills with 2 in. by $\frac{3}{8}$ in. wrought-iron strap hinges with screwed plates, each hinge cranked and bolted with six $\frac{1}{2}$ in. coach bolts, 3 in. oak wrought, grooved, and tongued and mortise clamped foot-boards 18 in. wide and of length equal to the width of opening. Fix on each side of opening a strong plate and staple and a length of stout chain connected with the hinge of the flap by an eye forged on the hinge.

Fix on the face of the lower of each of the two transomes before described a $3\frac{1}{2}$ in. diameter teak roller of length equal to the whole width of the opening, with wrought-iron pin, eye, and plate at each end.

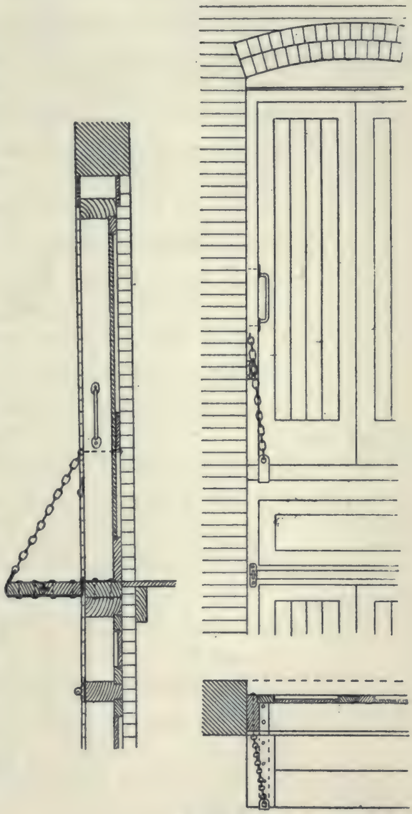


FIG. 43.

Fit each opening with two wrought-iron handles 12 in. long with stout plates screwed to the frame, and two wrought-iron hooks on screwed plates, weight 2 lbs. each.

Lift Enclosure

Enclose the back and sides of the lift on the upper floors with $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in. fir, wrought, chamfered, and grooved angle posts, $3\frac{1}{2}$ in. by 3 in. wall and intermediate posts, $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in. grooved and chamfered sills and head, and two intermediate rails each $3\frac{1}{2}$ in. by 3 in. Fill in the

panels with 1 in. matched and beaded both sides boarding in batten widths. Form openings in front with $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in. frame to match the posts, but rebated for doors.

Provide £25 for lift doors and fixing.

Ceilings. Finish the underside of the concrete floors with a thin setting coat of Portland cement.

Manufacturers of Ironwork. If the contractor does not intend to execute the constructional ironwork on his own premises and by his own men, or if the architect is not satisfied that he has sufficient means for the execution of the work according to this specification, he shall submit to the architect for his approval the name or names of such firm or firms as he proposes to employ for this purpose, and arrangements shall be made whereby the architect or his representative shall have power and facilities to visit the works of the makers of the ironwork, and inspect the work in progress, and at any time either before or after delivery to reject such work or parts of it as may seem to him not to comply with the terms of the specification. The architect shall have the power to have any defective castings broken up at once if he thinks fit.

Castings may be Broken Up.

Sub-contracting. Any sub-contractor shall be one who himself executes the whole of the work entrusted to him, and no further sub-contracting will be permitted.

Samples of the Ironwork. The architect or his representative shall have the right to select samples of the ironwork and to have any portion tested, the cost of which will not be charged to the contractor if the test should prove satisfactory, but if unsatisfactory the contractor shall be held liable for the cost of further tests and all expenses incurred.

Testing of Ironwork. Provide for any tests which may be at the expense of the building owner £10.

Dimensions of the Work. The dimensions on the drawings are believed to be correct, but the contractor shall be responsible for their accuracy, and shall examine them before putting the work in hand.

Weighing Machine. The contractor shall supply, set up on the premises, and maintain until the conclusion of the works, a weighing machine to weigh up to 2 tons, shift it from time to time as may be required, and remove at the completion of the works.

Cast-iron Patterns. Supply all patterns and, if required by the architect, submit them for approval before casting, and when more than one casting is required from the same pattern, submit the first casting before the remainder are made.

Contractor to be Responsible for Efficiency. The contractor, by the acceptance of the contract, shall be held to approve of the methods of construction adopted and the scantlings provided, and shall be held solely responsible for the strength and efficiency of the various works.

Castings. The stanchions, base plates, and other castings shall be clean, sound, smooth, free from flaws, holes, cinders, air blows, and all imperfections, the whole to be slowly and carefully cooled to avoid internal strains in the metal, and to be perfectly straight and true in shape. No lead or other plugging will be allowed. Test bars, 3 ft. 6 in. long, 2 in. deep, and 1 in. thick, shall be cast from the same meltings as those for the general work, and from as many meltings as the architect may direct. Such bars, when placed on bearings 3 ft. apart, shall bear 27 cwts. in the centre without breaking.

The top-bearing surfaces of all base plates and the junction flanges of all stanchions and columns shall be planed and extra metal shall be supplied to allow for the reduction of the thickness by such planing. All holes for bolts to have slightly raised boss cast on.

The metal of the columns shall be concentric and of uniform thickness.

Wedge up Bases of Columns and Stanchions. The bases of all columns and stanchions shall be wedged up with iron wedges 1 in. from the stone base, and run with pure Portland cement 1 in. thick.

Quality of Wrought Iron. The iron to be of the best quality, tough, fibrous, and even of uniform grain, the angles and tees equal to a tensile strain of 21 tons per square inch of sectional area, with a minimum reduction of area of 12 per cent., rod iron and bolts equal to a strain of 23 tons per square inch and a reduction of 13 per cent.

Bolts. All bolts to be of the sizes indicated on the drawings made from one piece of metal, and those $\frac{3}{4}$ in. diameter and upwards shall have hexagonal heads and nuts of proper proportions, the screwed ends of the bolts to project not less than $\frac{1}{8}$ in. beyond the face of the nut.

Quality and Description of Steelwork. All steelwork to be of the best English manufacture, to bear the name of an English maker, and to have an ultimate tensile strength of from 28 to 30 tons per square inch of section, with an elongation of 20 per cent. in a length of 8 in.

Rolled Sections. The rolled sections shall be truly and cleanly rolled to the full section, sizes, and weights per foot, as shown in the drawings or described in this specification, and shall be free from scales, blisters, laminations, cracked edges, and defects of every kind.

Rivets and Holes. The steel for the rivets shall be of mild quality, and shall not contain more than ·2 per cent. of carbon, the tensile strength must not exceed the limit of 25 to 27 tons per square inch of section, with an elongation of 50 per cent. in a length of 2 in.

The holes for rivets and bolts in steel girders and rolled joists are to be drilled and not punched. The riveting shall be executed in the best manner, all rivet holes fair and true, and exactly opposite each other. The rivets to fill the holes tightly and completely, to have sound and well-formed heads and snaps of uniform size. Any rivets loose or defective, or with burnt or cracked heads, shall be cut out and renewed with new or perfect ones.

Where the riveted girders rest on stone templates, or iron, the heads of the rivets shall be countersunk.

Bearings of Joists and Girders. Where the cast-iron lugs of stanchions or columns are bolted to the ends of the rolled girders and joists care shall be taken that the bearing comes on the head-plates and not on the bolts.

Connections of Joists. The junctions of joists with other joists transverse to them shall be carefully fitted, so that the ends of the joists shall touch the webs of those transverse to them, notching the flanges where required, or joggling or forging them, so as to produce a close joint.

Each smaller joist shall be fitted with a length of 2½ in. by 2½ in. angle steel on each side of it, of lengths equal to the depth of the flange of the joist and riveted or bolted with ½ in. bolts.

Caution as to Holes and Bolting. Avoid as far as possible holes and bolting in the flanges of the joists and girders, except at or near their ends.

Oil Metal. Thoroughly remove all scale to the bare metal and oil while hot with boiled linseed oil.

Architect shall pass Work after Oiling. The work will be inspected and approved in its oiled state, and no further coating shall be applied until the architect or his representative has passed the work.

Painting. After the approval the whole of the work shall receive one thin coat of oxide of iron paint before delivery, and a second coat upon all exposed parts after fixing.

Distance Pieces. Girders formed of two or more beams shall have between the webs, not more than 5 ft. apart, cast-iron distance pieces and $\frac{3}{4}$ in. bolts, two for girders 12 in. deep and over, and one for 10 in. girders and under.

Bearing of Joists and Girders. The bearing of joists on walls generally shall be 6 in. at each end, of those to spans of 20 ft. and over 12 in. at each end.

Size and Weight of Girders and Binders. Construct the floors of steel girders 12 in. by 6 in., 54 lbs. per foot run, binders 9 in. by $3\frac{3}{4}$ in., 20 lbs. per foot run.

Trimmers for Lifts. The trimmers for lift to be 5 in. by 3 in., 15 lbs. per foot run. Connect with angle plates, riveted and bolted as shown.

Stanchions. Supply cast-iron stanchions of ✚ section, with equal arms, fixed exactly upright, and all the base and top plates truly levelled, as follows :—

Basement,	8	stanchions,	13	in. diameter,	$1\frac{3}{4}$	in. metal.
Ground,	8	,,	13	,,	$1\frac{3}{4}$	,,
First floor,	8	,,	$11\frac{1}{2}$	,,	$1\frac{1}{2}$	,,
Second floor,	8	,,	10	,,	$1\frac{1}{2}$	,,
First floor,	8	,,	9	,,	$1\frac{1}{4}$	,,

The basement stanchions to have bases to detail of $1\frac{3}{4}$ in. metal.

Wrought-iron Sashes. The windows shall be fitted with wrought-iron sashes, by a maker to be approved, all framed, riveted, and put together in the best manner.

The sashes to have $1\frac{1}{2}$ in. by $\frac{3}{16}$ in. moulded and rebated frames, with rib in addition, and $1\frac{1}{2}$ in. by $\frac{3}{16}$ in. moulded and rebated bars, divided into squares, as shown on elevations.

Ventilators in Iron Sashes. The ventilating parts, marked thus X on the elevations, shall open outwards, shall be hung either at bottom or sides with gun-metal hinges, and fitted with strong wrought-

iron slotted stays 9 in. long, and strong wrought-iron Cockspur fastenings.

Electric Lift. Supply an electric lift to raise 15 cwt. from the basement to the fourth floor, with gear comprising 1 fast and 2 loose pulleys on the worm shaft, with worm cut out of solid, and running in coned thrust bearings, a large drum turned and grooved to suit steel wire rope, automatic brake fitted on the worm shaft, with striking gear and girders for mounting the whole, with cage 6 ft. long, 5 ft. wide, and 7 ft. high of 2 in. by 2 in. angle iron framing, riveted together with $1\frac{1}{4}$ in. deal, wrought enclosure, and $1\frac{1}{2}$ in. wrought both sides floors in batten widths, the whole fitted with safety apparatus. Supply fir guides, balance weight with guides, top wheels with spindles, bearings, girders, steel wire ropes for support and starting, the latter with automatic stop at top and bottom; also countershaft hangers, bearings, and pulleys in the basement, and all engineer's work required.

The motor, driving belts, and electric work will be a separate contract.

The lift shall be made and fixed by an engineer approved by the architect. All materials, fittings, and labour thereto shall be of the best quality. The lift shall be left in working order, and the contractor shall supply a guarantee of and be responsible for its successful working for a period of two years from its completion.

Build in forty 9 in. by $4\frac{1}{2}$ in. by 3 in. wood bricks with splayed ends for attachment of the wooden guides.

Form in basement floor a pit the size of the lift opening and 12 in. deep, with concrete bottom 6 in. thick, and concrete sides also 6 in. thick, with hole in the bottom for sheave 15 in. by 15 in. and 18 in. deep, the whole lined with cement floated face and asphalte, uniform with the basement floor. Fix in the bottom of the sheave hole two pieces of timber 7 in. by 4 in. and 21 in. long.

Chimney Shaft in all Trades. Construct the furnace chimney shaft as shown on drawing on Portland cement concrete 6 ft. in depth. Build the brickwork in mortar as described, except the topmost 10 ft. in height, which shall be built in cement. Face with Brown's best facing bricks pointed to match facing of the buildings adjacent. Finish at top with a moulded cornice, to detail, in bricks to match the facing. The cap to be a

Chimney Shaft in all Trades.

rim of 1 in. cast-iron with flange of width equal to the thickness of the brickwork at top of shaft, and accurately fitted to the plan of the top, as Fig. 44.

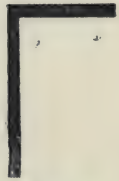


Fig. 44.

Lay at each 10 ft. in height above the footings 3 tiers of one row to each half brick in the thickness of the brickwork $1\frac{1}{4}$ in. by $\frac{1}{8}$ in. hoop-iron well lapped at joints and angles.

Line the chimney for a height of 20 ft. and a thickness of $4\frac{1}{2}$ in. with best Stourbridge fire-bricks set in fireclay, nowhere bonded to the general brickwork, and leaving a 2 in. cavity.

Form opening at bottom of shaft, turn a segmental arch thereover in two half-brick rings, fill in the opening with 9 in. brickwork built in mortar with a straight joint for future removal. Splay the internal offsets, and weather them with cement. Finish the inside faces of shaft with a neatly struck joint.

Weather the cornice with Portland cement, trowelled.

PUBLIC BATHS.—*See Notes, p.* 550.

In addition to the ordinary items of a contract there are certain special ones or variations of those before mentioned which may be required, as the following:—

Provisions. Provide for diving stage, including fixing, £40.

Provide for heating apparatus, &c., to be supplied and fixed by , £3,000.

Provide for attendances on heating engineer, £ .

Provide for fittings of laundry, ironing room, drying closets, and apparatus, to be supplied and fixed by , £ .

Provide for attendances on laundry engineer, £ .

Blow-off Chamber. Build the blow-off chamber in basement 2 ft. 3 in. by 3 ft. $4\frac{1}{2}$ in. in clear of one brick sides, with one course of footings, all in cement on cement concrete, the whole size of the excavation, and 9 in. thick. Cover with a 3 in. tooled York cover 3 ft. 9 in. by 4 ft. 9 in. with 3 in. iron ring and eye bolt passing through the stone, with screw end and large nut. Take from thence a 4 in. drain through nearest external wall, and connect with a 6 ft. length of 4 in. galvanized cast-iron pipe fixed to the external face of the wall.

Antill's Traps. Supply as outlets to the channel at sides of the swimming bath Antill's 6 in. cast-iron traps with brass grates let into rebated perforations and run with cement.

Gratings. Supply for the ventilation of the boiler-house four 14 in. by 9 in. cast-iron gratings $\frac{1}{2}$ in. thick, form openings through the wall, and render with cement.

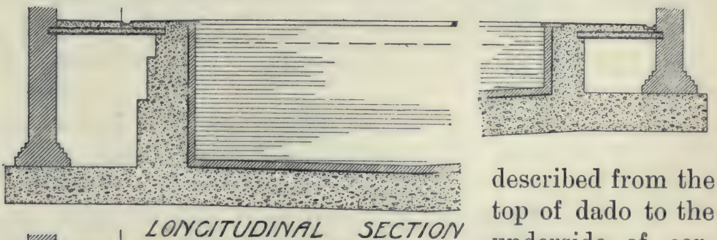
Supply where directed twenty-four 9 in. by 6 in. iron hit-or-miss gratings, and form and render the openings with cement.

Shower Bath. Dish the concrete of floor to form bottom of shower bath, and rebate the edge to receive grating. Render and trowel the dishing with neat Portland cement.

Fix in centre as outlet Doulton's 12 in. yard gulley with galvanized iron grating bedded in the concrete and connected with the drain.

Chamber for Water Meter. Build a chamber for water meter 36 in. by 18 in. and 24 in. deep all in clear of one brick sides and brick flat bottom, all built and rendered with cement on cement concrete 12 in. thick laid over the whole area of excavation. Supply cast-iron cover 30 in. by 18 in. opening (Tylor's $\frac{183}{39}$), corbel out the brickwork in cement to receive it, and bed it in cement.

Internal Facing of Swimming Bath. Face the walls of the swimming bath for a height of 4 ft. 6 in. from floor with red salt-glazed bricks as described from the top of dado to the underside of cornice with ivory-white glazed bricks. Supply a cornice to run all round the walls, including across the gable walls, of one course of red splayed glazed bricks, one course of red glazed bricks slightly oversailing, and one course of red glazed headers set flush and 4½ in. apart.



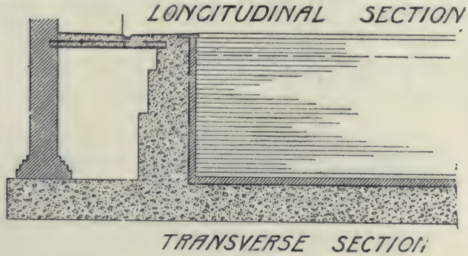


Fig. 45.

All the salient angles of this facing to be bull-nosed.

Swimming Bath. Construct the basins of the swimming baths to detail (Fig. 45) with cement concrete, as described, carried up in regular layers and grouted with cement, grout mixed in the proportion of 1 of cement to 2 of clean sharp sand.

Level the bottom of the bath to falls towards the outlet. Render and float the whole of the internal face of the concrete of the bath tank with cement mixed 1 to 2, line the whole of the tank with Claridge's Pyrimont Seyssell

Swimming Bath.

asphalte $\frac{3}{4}$ in. thick, put on in two thicknesses and breaking joint.

Pave the bottom of the basin with best white glazed bricks on edge in cement. Line the sides with best white glazed bricks, all stretchers in cement, and neatly joint the whole as the work proceeds. The topmost 3 courses of the glazed lining to be green of an approved tint.

Supply at one end of each basin and the whole length of the end Tiltman's white glazed scum and overflow channel (Cliff & Son, Baltic Wharf, Waterloo, S.E.) (Figs. 46 and 46A), connect with drain.

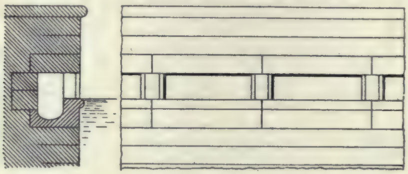


FIG. 46.

Form chamber in the bottom of the bath basin 2 ft. by 2 ft. and 2 ft. deep all in clear, and render it in cement and prepare it to receive iron outlet box supplied by the engineer.

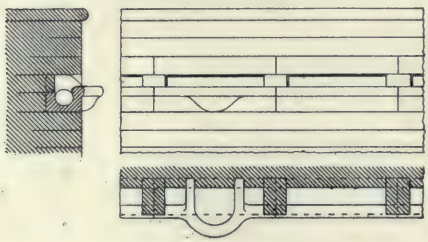


FIG. 46A.

Build a chamber 2 ft. $7\frac{1}{2}$ in. by 2 ft. $7\frac{1}{2}$ in. and 3 ft. deep for the sluice valve of 9 in. brickwork of glazed bricks in cement on cement concrete 9 in. thick, and the whole area of the excavation. Render and trowel the bottom with Portland cement 1 in. thick. Supply a 4 in. tooled York cover 3 ft. 6 in. by 3 ft. 6 in., with hole cut in it for the stem of the valve.

Curbs to Bath Tanks. Supply to bath tanks 14 in. by 3 in. rubbed York curbs in lengths of not less than 6 ft. with rounded edge set in cement and neatly back-jointed. The quadrant corners to be out of stones not less than 4 ft. by 4 ft.

Channels. Lay along the sides of each bath tank in front of the dressing boxes 9 in. by 3 in. rubbed York channel hollowed out for falls and in lengths of not less than 5 ft., bedded and jointed in cement.

Master Keys. The whole of the locks to be under one mastership with

eight master keys. The latches of boxes of each swimming bath and each department of the private baths to be under one mastership for each department.

Pay Boxes. Construct the enclosures to pay boxes of frame 4½ in. by 3 in. rebated and twice ovolo moulded posts, and transom 4½ in. by 3 in. twice rebated and four times ovolo moulded. Fill in the space below transom with 2 in. moulded both sides framing two panels high, the upper part with 1½ in. moulded bars in small squares, fitted with beads for glass screwed with brass cups and screws. Fit the spaces above the transoms with 2 in. moulded fixed sashes to match the framing below. Form an opening to detail in the sashed part of the framing of each pay box, hang therein with 1½ in. brass butts a 1½ in. mahogany moulded casement. Fit with a brass knob turn buckle, and small brass knob and button.

Fit in each pay opening 1¼ in. mahogany French polished shelf 1 ft. 6 in. by 1 ft. 6 in. circular on plan with all the exposed edges rounded and supported by a 1 in. shaped bracket 6 in. by 6 in. on each side of the partition.

The doors in these partitions to be 2 in. three panel moulded both sides, the upper panels with moulded bars for glass, and all to match the adjacent framing. Hang with 3½ in. iron butts, fit with 7 in. mortise lock and brass furniture.

Finish around inside and outside of the framing with 2 in. by 1 in. ovolo moulded fillet.

Dressing Boxes of Baths. Enclose the dressing boxes and attendants' boxes of swimming baths with 1½ in. square framed fronts, ends and divisions three panels high, the divisions housed into the fronts and the salient angles tongued and staff beaded. Finish at top with 3 in. by 2 in. grooved and twice moulded capping. Secure the framing to the floor by iron dowels about 18 in. apart.

Supply to each compartment 1½ in. three-panel square-framed door 2 ft. by 5 ft. 10 in., hung with 3½ in. iron butts. Fit with 4 in. brass spring latch, P. C. 5*s*. (exclusive of fixing), and a 2 in. china label with number, screwed on with brass screws. Finish around each door with 3 in. by 1 in. twice chamfered architrave screwed on as stop.

Supply in each dressing box 1¼ in. wrought both sides

Dressing Boxes.

seat 12 in. wide on chamfered bearers, a foot grating 2 ft. by 2 ft. of $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. laths wrought, halved, and pinned together $1\frac{1}{2}$ in. apart and with border, 1 in. by 6 in. wrought both sides shelf 12 in. long, on two 1 in. shaped brackets, 1 in. by $4\frac{1}{2}$ in. twice beaded peg rail, and two Japanned iron hat and coat hooks, P. C. — each.

Fix in each attendant's box where shown on plan three tiers of $1\frac{1}{4}$ in. wrought both sides shelves, the lowest 15 in. wide, the intermediate 11 in., and the highest 9 in. wide, also a $4\frac{1}{2}$ in. by 1 in. rail and pegs as described for the dressing boxes.

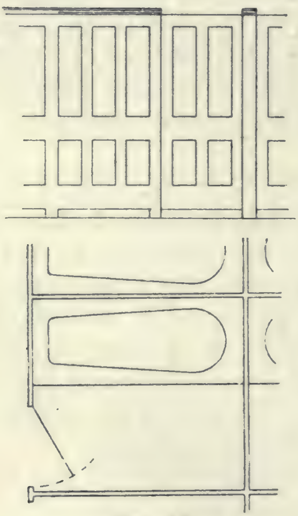


Fig. 47.

Enclosures of Private Baths.

Construct the enclosures of the private baths with $1\frac{1}{2}$ in. square framing as last described (Fig. 47), the doors to be 2 ft. by 6 ft. 3 in. hung and fitted as last. Supply seat, grating, shelf, rail, and pegs, all as described for the dressing boxes.

Shower Baths.

Enclose the shower baths with 2 in. deal framing three panels high and door, all as before, but flush framed one side to receive lead lining.

Supply to the bottom of the shower bath 2 in. deal framed grating, 2 ft. by 2 ft., and all as described for the dressing boxes.

Steps to Swimming Baths.

Supply to each bath tank four sets of oak wrought steps, 1 ft. 9 in. wide in clear of strings, two sets at deep end of the bath and two sets at the shallow end of 9 in. by 2 in. strings and $1\frac{1}{2}$ in. by 7 in. treads, 9 in. apart, and housed into the strings and all put together with white lead; chamfer all the exposed arrises, and bolt one string to the other by two $\frac{1}{2}$ in. galvanized iron bolts with large heads, nuts, and washers. Secure each ladder at bottom to the paving by two galvanized iron shoes, weight 4 lbs. each, and at top to the curb by two galvanized iron dowels let into mortises in the underside of the curb.

Seats in Waiting Rooms.

Supply in waiting rooms as shown on Plan $1\frac{1}{2}$ in. wrought both sides seats 15 in. wide, with rounded nosings, supported

by $1\frac{1}{4}$ in. by 14 in. by 17 in. wrought and shaped bearers, about 3 ft. apart, stop-housed into the underside of the seat and secured to the floor. The joints and intersections of the seats to be ship-lapped, the ends to be rounded and to have small quadrant corners.

Fittings in Pay Boxes. Supply where shown on Plan $1\frac{1}{4}$ in. mahogany French polished counter top with rounded edge. Put beneath this top $1\frac{1}{4}$ in. wrought both sides shelves and divisions and 1 in. wrought pot board and bearers. Supply a deal drawer 15 in. wide, 6 in. deep, and of length equal to the width of the top of 1 in. deal beaded front, $\frac{3}{4}$ in. sides and $\frac{3}{4}$ in. bottom, dovetailed and grooved together in the best manner, glued and blocked, and with hard wood runners screwed on. Fit with 3 in. brass cup handle and brass drawer lock, P. C. 5*s*., exclusive of fixing. Frame between the divisions 2 in. by $1\frac{1}{2}$ in. beaded rail, and screw to the division 2 in. by 2 in. runners to receive the drawer.

Rail to Swimming Bath. Fix around each swimming bath just above water level 2 in. galvanized iron best welded steam tubing as rail, with a bend at each angle and supported every 2 ft. 6 in. by galvanized wrought iron eyes, with stems and fanged ends built into the brickwork, weight 3 lbs. each.

Exit Doors. Fit the doorways marked A on Plan with $2\frac{1}{2}$ in. doors, 6 ft. by 7 ft. 6 in., in eight panels the set, moulded inside and with moulded and raised panels outside. Hang to open outwards with three pairs of strong purpose made wrought iron projecting hinges, $7\frac{1}{2}$ in. by 8 in. Fit with a set of Smith's (Birmingham) patent panic bolts and a set of wrought iron purpose made plates with two clips, and Hobbs' $2\frac{1}{2}$ in. brass patent lever padlock for securing the fastenings when not in use. The frame to be 6 in. by 4 in. rebated and twice beaded. Finish inside with 3 in. by $1\frac{1}{4}$ in. moulded architrave.

Diving Stage. Construct the diving stages to detail (Fig. 48) in teak. All exposed surfaces to be wrought, the heads of all screws to be countersunk and about 9 in. apart.

Construct the framework of rolled steel, all riveted or bolted together, and cleated in the best manner. The horizontal member to be 3 in. by 2 in. channel, let into the floor. The end uprights to be 3 in. by 2 in. channel. The intermediate uprights 3 in. by 3 in. rolled joists. The

Diving Stage. top rail supported by 2 in. by $1\frac{1}{2}$ in. rolled T stay, the uprights to the wall by four lengths of $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. T forged, caulked, and cut and pinned into the walls.

The top rail of centre part to be 2 in. teak, shaped to design, rounded on top edge, and screwed with 2 in. screws to the steel bearer.

The sill to be of 2 in. by 2 in. teak, fitted and screwed to the floor channel.

The top rail of side bays to be 2 in. by 2 in. teak, screwed with 2 in. screws to the T steel, and the upper edge rounded.

Fit to the steel upright channels and joists $2\frac{1}{4}$ in. by

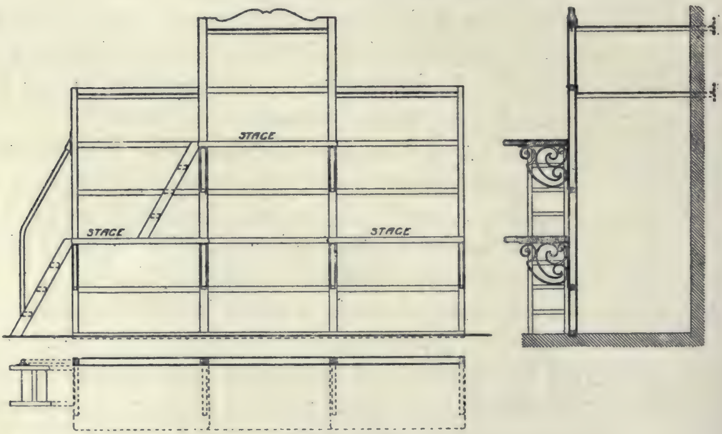


FIG. 48.

2 in. teak fillets; frame between these 2 in. by 2 in. teak rounded intermediate rails.

The stages to be of 2 in. teak, the edges rounded and with small quadrant corners, each supported by two wrought iron ornamental brackets of $1\frac{1}{2}$ in. by 2 in. back and top and 1 in. by $\frac{1}{4}$ in. scroll, neatly riveted together and to the steel standards.

Construct the step ladders in teak, of $3\frac{1}{2}$ in. by $1\frac{1}{2}$ in. strings and 3 in. by $1\frac{1}{2}$ in. treads, rounded on front edge, and housed and wedged. Bolt the strings together (two to each ladder) with $\frac{1}{2}$ in. galvanized iron screw bolts, passing across the ladder. Fit the ladder to the lower stage with $1\frac{1}{2}$ in. brass cased tube, bent as handrail, and secured at

each end to a brass moulded boss with socket, and screwed to string and standard.

Drinking Fountain. Supply in each swimming bath a wall fountain with stop cock, P. C. £3 10*s*., in all, at manufactory, and fix in the wall. Fit with 1 in. lead waste, to deliver into the channel in the paving at side of bath.

Electric Bells. Supply in each compartment of private baths a push, P. C. 2*s*. 6*d*., exclusive of fixing with gong, P. C. 13*s*., to ring and indicate in attendants' box.

Lining of Shower Bath. Line the partitions and door of the shower bath enclosure with 5 lbs. lead, closely copper nailed, and lapped and welted at joints.

Supply in each shower bath compartment Tylor & Son's (Newgate Street) bracket shower bath apparatus (Fig. $\frac{88}{87}$), and lay on the water from the nearest supply with 1 in. pipe.

Private Baths. Fit each first-class private bath enclosure with Rufford's best glazed roll rim porcelain bath, top length outside 74 in., brown glazed outside, and supported on five No. 4 glazed feet, bedded and jointed in white lead. Fit each second-class private bath enclosure with Rufford's bath, as last, but second quality. Cut hole for waste and fit with Bolding's 2 in. No. 732 brass grated washer with fly nut and bent union, and connect by 2 in. welded steam tubing with the general waste.

Wastes. Carry along the middle of each department of private baths 4 in. iron galvanized waste pipe, the joints run with molten lead, and connected with a similar vertical pipe outside of wall, connected with drain at foot, and carried up from thence to a height of 4 ft. above the parapet. Finish at top with Bolding's No. 1074 simplex ventilating cap.

All junctions shall be fitted with approved heavy brass caps and linings of the same clear size as the internal diameter of the pipe. All these shall be easily accessible.

The main horizontal wastes shall be laid in a channel 6 in. wide in the floor, covered with a cast-iron ornamental grating $\frac{3}{4}$ in. thick, in 6 ft. lengths, with planed joints.

Valves. Supply for each private bath a set of Doulton's brass bath valves, with index plate and unions, P. C. £3 per set, exclusive of fixing. The valves to be fixed for regulation from the outside of the enclosure.

Case each set of valves in $\frac{3}{4}$ in. pine, fitted to remove and screwed with brass caps and screws.

Supplies. The engineer's contract provides for the bringing the piping for both hot and cold water near to all private baths and apparatus; he will leave studs properly tapped on the main pipes for the connecting of the supply pipes by the general contractor.

Similar connections will be provided for the laundry apparatus supplied by Messrs. ————, who will make all their own connections.

Cold Water Supplies. From the engineer's nearest connection, with brass union and fly nut and 1 in. lead pipe, lay on the water to shower baths.

From the pipe last described, with $\frac{1}{2}$ in. lead pipe, lay on the water to drinking fountain.

From the engineer's nearest connection, with 1 in. lead pipe, lay on the water to each urinal.

From the nearest lead pipe, with $\frac{1}{2}$ in. lead pipe, lay on the water to waste-preventing cisterns of w.c's.

From the engineer's nearest connection, with brass union and fly-nut $\frac{3}{4}$ in. lead pipe, and $\frac{3}{4}$ in. Tylor & Son's best quality brass upright, quick-turn, screw-down, lavatory valve, with spoke knob, lay on the water to each lavatory.

From the engineer's nearest connection, with brass union and fly-nut and 1 in. pipe, lay on the water to each private bath.

Hot Water Supplies. From the engineer's nearest connection, with $\frac{3}{4}$ in. union, $\frac{3}{4}$ in. iron pipe, and $\frac{3}{4}$ in. lavatory valve as before, lay on the water to each lavatory.

From the engineer's nearest connection, with 1 in. union and 1 in. iron pipe, lay on the water to each private bath.

Stop cocks. Fix in each subordinate supply both hot and cold, and close to the engineer's connection a best quality brass high-pressure, screw-down stop cock, with unions at each end.

Engine Bed. Construct the engine bed of cement concrete as described and to detail, or instructions supplied by the engineer, build in lengths of $1\frac{1}{2}$ in. iron barrel for the holding down bolts to pass through.

Render, float, and trowel in Portland cement 1 in. thick the top and sides of the concrete where exposed, and make good after the fixing of the engine.

Engine Bed. Build foundation for engine (see Fig. 49) of brickwork in cement, with three courses of footings on cement concrete 18 in. thick. Lay thereon and bed in cement a block of hardest Yorkshire stone 7 ft. 7 in. by 4 ft. 6 in. and 2 ft. thick, shaped as sketch, rubbed on all exposed edges, and with six holes for holding-down bolts. Leave openings in the brickwork beneath until the bolts are fixed and make good afterwards.

FIG. 49.

Foundations for Hydros. Construct the foundations for hydros. of 18 ft. by 6 in. English wrought oak, bore them where directed for the holding-down bolts, and bed them in cement.

Washing Machines. Form bed for the washing machines in cement concrete 18 in. thick, form therein a square dished and mitred sinking, 4 ft. 6 in. by 2 ft. 6 in. and 9 in. deep, rendered, floated, and trowelled with cement. Fix in the bottom of this Doulton's Fig. 15 yard gulley, with dished cover 12 ft. by 12 ft. outside and 9 in. hole and galvanized cast-iron grating bed in cement and connect with drain. Finish around the edge of dishing with 3 ft. by 3 ft. rubbed York curb bedded and jointed with cement.

Supply 7 ft. by 7 in. hardest York curb-rubbed where exposed, twice chamfered and bedded, and jointed with cement. Cut mortises where directed for lewis bolts and run with lead.

UNDERGROUND CONVENIENCES.—*See Notes, p. 556.*

In addition to the ordinary items of a contract there are certain special ones or variations of those before mentioned which may be required, as the following:—

Water. The contractor will be allowed to obtain water for the works, free of charge, from the vestry's nearest water post, but he shall convey it to the works and supply any requisite temporary plumbing and storage.

Office for Surveyor. Supply a suitable office for the surveyor's assistants, with such convenience for writing and keeping papers as may be required by them, and supply satisfactory desks, firing, light, and attendance.

Leave Clean. Clear away all dirt, rubbish, and superfluous materials as they accumulate. Wash and scrub floors and stairs at completion. Clean the glass in the pavement lights, and leave the whole of the work clean and perfect at completion.

Public Traffic. Make such provision for traffic as shall be satisfactory to the surveyor. Supply all barriers, fences, screens, gangways, notice-boards, lights, and watching necessary to completely protect the public from inconvenience and accident, and the works from injury.

Support Footways, &c. **Make good Damage.** Shore up and efficiently support the footways and railings, propping, slinging, and supporting all gas and water mains and pipes, so as to prevent injury thereto by the execution of the works, and reinstate and make good all damage or injury occasioned by such operations, to the entire satisfaction of the owners thereof and of the surveyor.

Contractor to be Responsible for all Public Works. The contractor shall be responsible for the safety and security of all pipes, valves, boxes, gas and water mains, tramways and all works connected therewith, and of all land, roads, footways, pavings, curbs, railings, buildings, sewers, drains, gulleys, and property of every description affected by these works during their execution or the period

of maintenance, and shall give all notices to the respective companies or persons interested, and shall take such measures as shall completely secure the same from injury, and shall make good any damage or injury, and pay all costs and charges for compensation, for loss or damage consequent upon these works.

Take up and Deposit Street Paving. Carefully take up and deposit where directed, about 520 ft. superficial of street paving, which will be re-laid by the vestry without charge to the contractor.

Provision for Gates. Provide for a pair of Bostwick gates with top and bottom tracks, delivered and fixed £13 15*s*. Contractor to supply attendance, cutting away, and making good in all trades.

Quality of Cement. All cement to be Portland of approved manufacture, having a specific gravity of not less than 3·1 one month after being ground, and leaving not more than 10 per cent. residue when sifted through a sieve containing 2,500 meshes per square inch. Pats of neat cement made with not more than 20 per cent. of water, to set in not less than 3 hours, or more than 6 hours, and briquettes made with the same proportion of water and placed in water 24 hours after being made up, and allowed to remain therein for seven days after being made up, and tested immediately after removal from the water, are to stand a tensile strain of not less than 350 lbs. per square inch.

Cramps for Coping. Connect the coping with the brickwork by galvanized wrought-iron cramps (Fig. 50) $1\frac{1}{4}$ in. by $\frac{3}{8}$ in. and 19 in. long, one end caulked, let 3 in. into the coping, and run with cement, the other end bent and let into the brickwork as sketch.

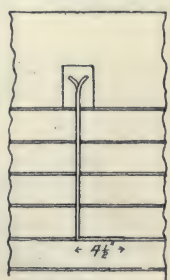


FIG. 50.

Curbs for Pavement Lights. The curbs to receive the pavement lights shall be 7 in. by 6 in., finely tooled all around, rebated, and with joints dowelled with a 1 in. by 1 in. by 4 in. slate dowel to each, bedded in mortar of equal parts of lime, putty, and Portland cement, and jointed with cement.

Mirrors. Fix over each lavatory basin a mirror, the glass 3 ft. by 2 ft. of British polished plate of the best silvering quality, the edges bevelled 1 in. wide, the whole silvered in the best manner, and with a backing of stout blanket flannel. Fit

the glass in a frame of best Austrian wainscot, rebated, reeded, and moulded, with its angles tongued, mitred, and screwed. The back to be ¾ in. pitch pine, wrought both sides, and accurately fitted to the frame.

Indicating Bolts.

Fit each w.c. door with Ashwell's (T. & W. Farmiloe, Rochester Row, Westminster) special "Navy" polished gun-metal indicating bolt, P. C. 10*s*. 6*d*., a brass latch with key (Charles Smith & Sons, 12, Oxford Circus Avenue, W.), No. 1,239, a brass knob, No. 284, of the same manufacture, and a mahogany stop with india-rubber buffer.

Iron Direction Plates.

Fix at the top of each flight of steps an approved enamelled iron plate with bevelled edges, 7 in. by 24 in., and lettered "way in" and "way out" respectively. Fix with stout screws to teak plugs in the brickwork.

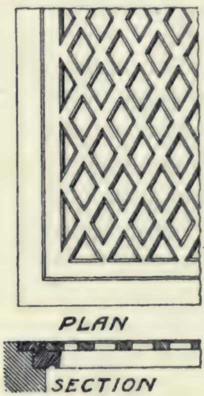


FIG. 51.

Gratings.

Supply where shown on plan, ¾ in. cast-iron gratings (Fig. 51) with 3¾ in. by 2¾ in. frame as sketch, coated while hot with a mixture of boiling tar and pitch, and the frame bedded in cement.

Pavement Lights.

Supply where shown on Plan, Hayward & Eckstein's (Union Street, Borough) pavement lights, section 2 C C, the lenses bedded in red lead, and the frame bedded in cement to the curb.

Rain Guards.

Fix beneath the gratings two No. 18 B. W. G. galvanized rain guards (Fig. 52) 9 in. girth, as sketch, and the whole length of gutter.


FIG. 52.

Gutters.

Fix below these guards and the whole length of the grating, 12 in. by 6 in. by ½ in. cast-iron gutter, as sketch (Fig. 53), bolted and jointed in red lead cement, and supported by 2 in. by ½ in. wrought iron straps one end bolted to the steel joists with ½ in. bolts, and the other pinned into brickwork.


FIG. 53.

Rain-water Pipes.

Supply the necessary stopped ends, outlets with nozzles, and 3 in. rain-water pipes with shoe to deliver at floor level.

Lamp Posts as Outlet Ventilators.

Fix at each end of the structure a lamp column of the pattern known as M. B. W. (Pontifex & Co., 22, Coleman Street, E.C.), but the bottom flange, or two

sides, omitted, and in the remainder of flange four holes formed for $\frac{3}{4}$ in. bolt, the four openings omitted from lower part of column, and with openings made in the upper part of column as outlets. Fix the base to the brickwork with four $\frac{3}{4}$ in. bolts 18 in. long. Fit each column with Pontifex & Co.'s No. 21A, 24 in. Lambeth pattern hexagonal lamp, with spray irons, two brass burners, governor for 12 cubic feet per hour, tap and all necessary fittings.

Iron Panels. Fit to each space (Fig. 54) between the bars of balustrade between bottom and intermediate rail, a panel of $\frac{3}{16}$th in. wrought iron accurately cut and filed to shape, and riveted with four rivets as sketch.

Fixing of Lead Pipes. The lead pipes shall be so fixed to the wall or beneath the joists, that there shall be a space of $1\frac{1}{2}$ in. or such other space as the surveyor shall require between every part of the pipe and the wall or joist, and all the iron brackets, suspending straps, clips or wall hooks used for fixing or supporting the pipes shall be so made as to enable these requirements to be complied with to the satisfaction of the surveyor.

FIG. 54.

All brackets, suspending straps, clips and wall hooks are to be of galvanized wrought iron, of such patterns and shapes as shall be approved by the surveyor, and fixed at such distances as will support the pipes without sagging.

Urinals. The marble for the backs, ends, divisions, cappings, &c., shall be Rouge Royal, highly polished where exposed, and the edges rounded and made to detail drawing. The whole to be free from cracks, flaws, and stopping, and all set in Parian cement. The divisions shall be $1\frac{1}{4}$ in. thick, the remainder 1 in. thick. The divisions and ends shall be in single slabs. All corners of divisions and ends shall be quadrant shaped. Bed the ends and the wall lining against the brickwork on a carefully prepared Portland cement floated face. Fix each division with two $\frac{3}{4}$ in. by 1 in. copper cramps 9 in. long, the ends turned up or down, one end let into mortise of the marble, the other built into the brickwork.

Fit each compartment of urinal with an enamelled

Urinals. fire-clay back and bottom, circular on plan, in one piece of Twyford's (Cliff Vale pottery) best quality with outlet for waste, and 2 in. white enamelled waste carried into channel hereafter described.

Supply channel in floor for the whole length of urinal range of 6 in. white enamelled stoneware bedded and jointed in cement to fall in the concrete of floor. Form sides to this channel of 1 in. sawn and rubbed slate in not less than 4 ft. lengths, bedded and jointed in cement. Lay over this channel galvanized cast-iron grating $\frac{3}{4}$ in. thick, made in convenient lengths for removal, with rebated frame 2 in. by $1\frac{1}{4}$ in., the grating and frame 8 in. wide in all, and bed the frame in cement.

Lavatory. Supply in each lavatory a 17 in. by 12 in. (inside measurement) white earthenware basin with overflow, india rubber buffers, and earthenware receiver with glazed grating and notchings for wastes from soap and brush trays, the basins to be fitted for lifting out. Fit each basin with ornamental cast-iron pedestal as waste pipe from receiver, fixed to the tile and concrete floor, by six $\frac{1}{2}$ inch lewis bolts, one end jagged, the other with screw end, nut and washer.

Supply to each lavatory 1 in. highly polished Rouge Royal marble top, with rounded and throated front edge and oval perforation also with rounded edge. Finish at back and ends of each top with 6 in. by 1 in. skirting of similar marble rounded on upper edge and ends, and fixed with brass screws and cups to teak plugs in the brickwork.

Support each lavatory top in front by a 6 in. by $1\frac{1}{2}$ in. wainscot, moulded and French polished rail.

Flushing Cisterns and Sparge Pipes. Supply where shown on drawings three 6 gallon automatic half hexagonal flushing cisterns of 1 in. polished slate with polished plate glass panels, the whole of the flushing apparatus and fittings to be of polished copper with ball valve and brass connections for supply and flush. Fix each cistern on two approved ornamental galvanized cast-iron brackets screwed to teak plugs in the brickwork. Supply to each compartment of urinal back a $\frac{3}{4}$ in. sparge pipe of stoutest copper with holes about $\frac{3}{8}$ in. apart and $\frac{1}{16}$ in. diameter. Fit each sparge pipe at the ends with

Flushing Cisterns and Sparge Pipes.

stout copper caps screwed on, and a stout brass tee piece in the middle of its length. Each sparge pipe shall be bent to circular plan to fit the back and carefully secured thereto by copper clips.

Connect the flushing tanks by 1 in. pipe with 1 in. horizontal pipe carried along the back of urinal range and connected by $\frac{3}{4}$ in. pipe with the sparge pipe of each urinal.

SHOP FRONT. (Figs. 55 and 55A.)—*See Notes, p.* 557.

In addition to the ordinary items of a contract there are certain special ones or variations of those before mentioned which may be required, as the following :—

Provide for sun blind and gear and fixing £ .

Provide for revolving shutter, gear, grooves, and movable stiles £ .

Sash. Construct the shop front to detail of 3 in. sash moulded and rebated of bottom rail 4 in. by 3 in. Top rail $3\frac{1}{2}$ in. by 3 in., stile next wall 3 in. by 3 in., stile next doorpost 5 in. by 3 in., sash bars 2 in. by 3 in., angle bar out $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in., flush moulded on the salient angle, transom 3 in. by 3 in. Fit the whole with beads for glass fixed with small brass screws and cups.

Finish on the outside with 1 in. by $\frac{1}{2}$ in. guard bead.

Casements. Fit the space above transom with $1\frac{1}{2}$ in. moulded casements, one hung with 3 in. brass butts to the transom, fitted with a pair of 9 in. brass casement quadrants, and a brass spring casement catch.

The other casements to be similar but fixed. Tongue the stile next the doorway to the doorpost with two hardwood cross-tongues. The whole of the foregoing to be in Cuba mahogany.

Backing to Stall Board. Framing Show Board. Support the sash and the bearers of show board by fir partition of 3 in. by 3 in. head sill and posts, and 3 in. by $2\frac{1}{4}$ in. quarters 18 in. apart. The show board to be of 1 in. deal with rounded nosing on 3 in. by 2 in. bearers 18 in. apart.

Finish beneath the nosing with $1\frac{1}{2}$ in. by 1 in. bed moulding. Enclose the space beneath show board (in shop) with $1\frac{1}{2}$ in. moulded and square framing. Form two one panel doors therein, hang with $2\frac{1}{2}$ in. iron butts and fit each with brass knob turn-buckle.

Stall Board Framing. The stall board framing to be $1\frac{1}{2}$ in. moulded and square

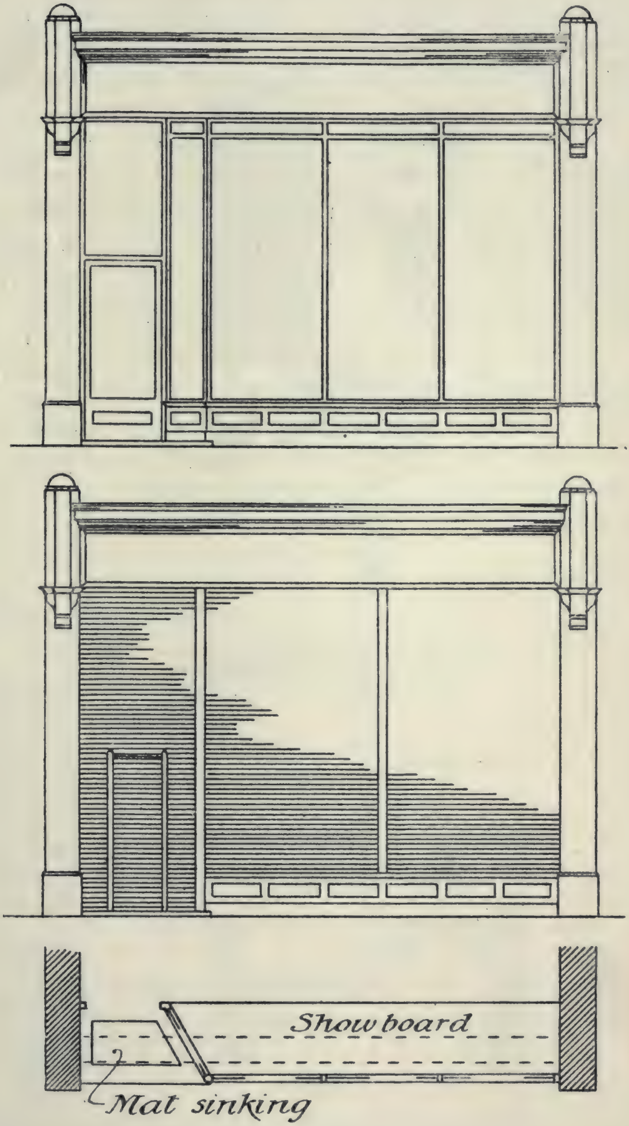


FIG. 55.

the salient angle, tongued, grooved and staff beaded, and finished at top with $3\frac{1}{2}$ in. by $2\frac{1}{2}$ in. moulded and twice

rebated capping housed to the door frame, and tongued mitred and screwed at the salient angle. Finish at bottom with $1\frac{1}{2}$ in. by 7 in. deal moulded skirting.

Cradling for Fascia.

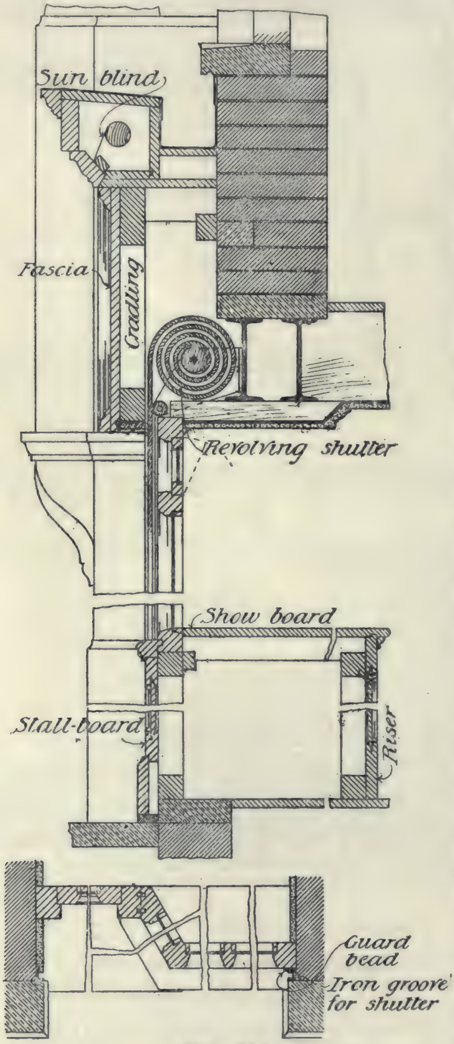


FIG. 55A.

Construct the cradling for fascia of 7 in. by 3 in., head $5\frac{1}{2}$ in. by 3 in., sill 4 in. by 3 in., posts 3 in. by 3 in., quarters 24 in. apart. Connect the head and sill by two $\frac{3}{4}$ in. bolts, passing through both. Secure this cradling by 4 in. by $2\frac{1}{4}$ in. stays, nailed to rough deal fillet, plugged to the wall. Cover these stays for the whole length of front with 1 in. deal wrought cover board.

Fascia.

The fascia shall be $1\frac{1}{4}$ in. Honduras mahogany, wrought keyed and cross-tongued in one length, fixed with stout brass screws and cups to the cradling and fitted to remove, 1 in. Honduras mahogany soffit tongued to the fascia. Finish the fascia in front with $1\frac{1}{2}$ in. by 3 in. deal moulding planted on and mitred at angles.

Blind Box.

Construct the blind box of top, bottom and back of $1\frac{1}{4}$ in. deal, rebated and grooved together, and glued and blocked, the front of 2 in., screwed and fitted to remove. Finish

with $2\frac{1}{2}$ in. by $3\frac{1}{2}$ in. deal moulding, planted on as cornice, and supply deal moulding out of 6 in. by 2 in. as front to blind lath.

Gutter. Put 1 in. deal gutter with $1\frac{1}{4}$ in. drips and $1\frac{1}{4}$ in. cesspool behind the blind box. Line the gutter with 7 lbs. lead. Cover the top of blind box with 6 lbs. lead. Flush the gutter with 5 lbs. lead.

Shop Door. The door to be 2 in. two-panel, moulded both sides, the upper panel with diminished stiles rebated and prepared for glass with movable beads screwed with brass screws and cups, hang with one $3\frac{1}{2}$ in. brass butt, and James Adams' (Union Street, Borough) "slave" hinge. Fit with brass shop door latch, P. C. 10*s*., and one $\frac{3}{4}$ in. by 9 in., and one 1 in. by 12 in. brass flush bolt with lever handle.

The frame to be $4\frac{1}{2}$ in. by 3 in. deal, rebated, moulded, and beaded with $4\frac{1}{2}$ in. by 3 in., transom moulded, rebated, weathered, and twice beaded. Fit the space above transom with 2 in. Cuba mahogany moulded casement fixed, the lower edge splay rebated. Fit with small beads for glass screwed with brass cups and screws.

Attendance on Blind Maker and Shutter Maker. Attend on and make good in all trades after shutter maker and blind maker.

Glazing. Glaze the sashes, casements, and door, with British polished plate of the best glazing quality.

PUBLIC HOUSES.—*See Notes, p. 560.*

In addition to the ordinary items of a contract there are certain special ones or variations of those before mentioned which may be required, as the following :—

Provide for insurance of plate glass £10.

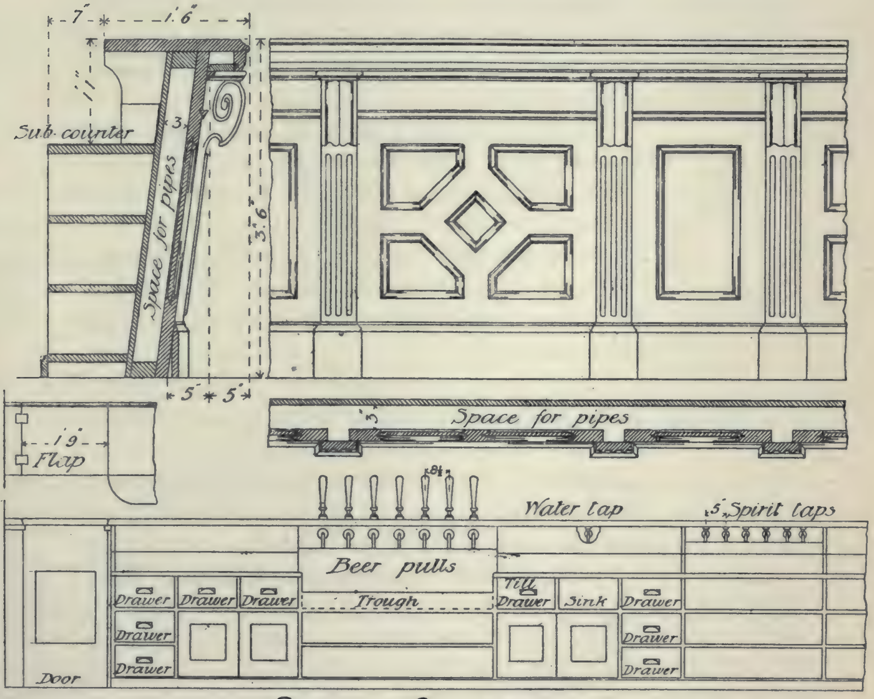
Provide for pewterers' work £120.

Counter. Construct the counter to detail (Fig. 56) of $1\frac{1}{2}$ in. top wrought both sides, and fixed with oak button blocks and brass screws. Clamp the exposed ends next flaps with 4 in. by $1\frac{1}{2}$ in. framed clamps, and cross-tongue all the heading joints. Mould the outer edge and tongue beneath it $1\frac{1}{2}$ in. by $3\frac{1}{2}$ in. moulded fillet, with $\frac{3}{4}$ in. soffit also tongued in all the foregoing in Cuba mahogany. The front to be of $1\frac{1}{2}$ in. deal moulded and square and fixed sloping.

Finish at bottom with 7 in. by 1 in. moulded skirting. Tongue into front $1\frac{1}{4}$ in. by 1 in. moulding to form frieze all in deal. Fit three of the wider bays to remove, each with two brass stubs and plates, and two 4 in. by $\frac{1}{2}$ in. brass flush bolts, the joint of upper edge to be rebated. The pilasters to be out of solid $4\frac{1}{2}$ in. by 5 in., the upper part of each to be moulded as truss with moulded returns, the lower part to be moulded as skirting, the front reeded, the upper part moulded to match the bed moulding.

Fit between the pilasters and mitre thereto, and tongue to the counter front $1\frac{1}{4}$ in. by $1\frac{1}{4}$ in. bed moulding rebated on back edge, and let into groove. Fit each space in the counter front where the flaps occur, $1\frac{1}{2}$ in. one panel moulded and square door, the outer edge of the door and the framing adjoining rebated, hang with $3\frac{1}{2}$ in. brass butts. Fit with Hobbs' 4 in. half-rebated brass mortise latch with half set of brass furniture. Fit flaps in counter

Counter. top where shown on plan, 1½ in. thick Cuba mahogany, mortise and mitre-clamped both edges, the ends of each flap and the counter top adjoining to be rebated. Hang with 4½ in. by 2 in. brass counter hinges, and where they touch framing, when open, fix an indiarubber buffer. Enclose the ends next flaps with framing to match the front, the salient angles next front to be staff beaded,



BACK OF COUNTER

FIG. 56.

rebated and grooved, the quadrant angles next back to be solid, out of material 2¼ in. thick.

Fix about 4 in. behind the counter front for its whole length as space, for pipes ¾ in. matched and beaded boarding in 4 in. widths fixed to rough fillets.

Fit inside counter with 1¼ in. wrought both sides shelf sunk for bowls 1 in. pot board and bearers, with 1 in. riser rebated and grooved in, and 1¼ in. wrought both sides

Counter. divisions, and shelves, the exposed edges of divisions twice staff beaded.

Fix the spaces where drawers are shown with drawers of 1 in. wrought and secret dovetailed fronts, $\frac{3}{4}$ in. dovetailed rims, and $\frac{3}{4}$ in. bottoms, all glued and blocked, and with $\frac{1}{2}$ in. by $\frac{1}{2}$ in. wainscot runners let in and glued. Screw to the divisions adjoining drawers 1 in. by $1\frac{1}{4}$ in. wrought runners.

Where the drawers are in nests of three, frame into the divisions between the drawers 2 in. by $1\frac{1}{4}$ in. twice beaded rails, and fit between the drawers $\frac{1}{2}$ in. dust partitions grooved in all around.

Fit each drawer with a $2\frac{1}{2}$ in. brass cup handle, and Hobbs' $2\frac{1}{2}$ in. brass drawer lock.

Fit each cupboard under the drawers with $1\frac{1}{2}$ in. moulded and square doors, hung with $2\frac{1}{2}$ in butts. Fit each of the single doors with brass knob turn-buckle, and 3 in. iron cupboard lock. Fit each pair of folding doors with brass knob turn-buckle, 3 in. iron cupboard lock, and 4 in. iron flat necked bolt.

Supply to support the counter at intervals where shown $1\frac{1}{4}$ in. shaped brackets twice staff beaded on outer edge, and housed at top and back edge.

Cover the sub-counter with polished pewter $3\frac{1}{2}$ lbs. per foot superficial, carefully dressed, turned up against vertical faces 6 in., and the edges beaded.

Counter Screen. Supply for the whole length of counter (Fig. 57) a screen of Cuba mahogany constructed to detail as follows, of 13 in. by $1\frac{1}{4}$ in. wrought both sides, shelf moulded on both edges and ends, $6\frac{1}{4}$ in. by $\frac{3}{4}$ in. rail at front edge of shelf, rounded on upper edge, rebated on lower, and let into groove pierced with sawn fret-work to design, and carefully cleaned up at completion. Support the shelf by $2\frac{1}{2}$ in. turned and shaped pillars tenoned at top to the shelf, and with shouldered tenon at bottom, passing through counter top with screwed end and oak nut. Supply at top of each pillar four $\frac{7}{8}$ in. shaped brackets $3\frac{3}{4}$ in. by 3 in. rebated on back and upper edges and let in.

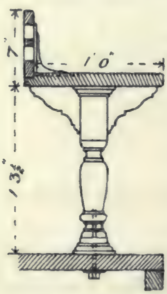


FIG. 57.

Finish around brackets and pillars with $\frac{5}{8}$ in. by $\frac{3}{4}$ in. bed moulding rebated and let in.

Bar Divisions. The bar divisions to be of Cuba mahogany, 2 in. moulded both sides, three panels high, the upper panels rebated and prepared for glass, with mouldings screwed with brass cups and screws. Finish at top with $2\frac{1}{2}$ in. by $1\frac{1}{2}$ in. capping moulded both edges.

In one division form a four panel door, both door and framing rebated all round. Hang with 3 in. brass butts. Fit with a 3 in. brass mortise latch with pull for opening it from behind the counter.

Elbow Screens. Fix at end of each bar division (Fig. 58) on the counter 2 in. one panel moulded elbow screen to detail, the capping of the bar division continued on the exposed edge down to counter.

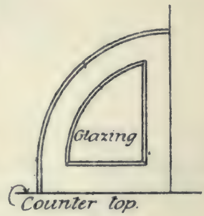


FIG. 58.

Rolling Way. Fix in rolling way two 5 in. by 3 in. oak sawn beams as barrel slide, each framed at bottom into 5 in. by 3 in. sawn sleeper, bedded flush with floor.

Curb. Supply curb for flaps 6 in. by 4 in., rubbed where exposed, rebated for frame and bedded and jointed with cement.

Cellar Flaps. Supply Hayward & Eckstein's No. 4 pattern section B. pavement light, hung as folding flaps, the frame fitted to the stone curb and run with cement. Fit the flaps with eight ventilating panels instead of glass lenses.

Counter Tops. The counter top shall be of $1\frac{1}{4}$ in. St. Anne's marble with plain edges, in lengths of not less than 5 ft. Each slab to have four oak button blocks and stout brass screws screwed with lead plugs in the underside of the marble for fixing to the wooden bearers (elsewhere described). The joints to be in Parian cement coloured to match the marble.

COLD STORAGE.—*See Notes, p. 562.*

In addition to the ordinary items of a contract there are certain special ones or variations of those before mentioned which may be required, as the following:—

Specification of Refrigerating Plant on the Linde system for a storage building of a capacity of 33,000 cubic ft.

ENGINEER'S WORK.

Supply and Delivery. The engineer shall supply and deliver at the railway station nearest to the building, and fix in the building, the whole of the plant hereafter described.

Unloading and Carting. The general contractor shall unload the machinery at the railway station, cart it to the building, unload, get it into the building, and deposit where directed, and shall cut away for and make good after the engineer. He shall also construct and alter as the engineer shall direct, any part of the insulation as may be required to ensure the efficiency of the apparatus.

Maintenance of Given Temperature. The plant supplied shall be capable of maintaining a temperature of 25° Fahrenheit, and in case of its failure to do so within three months of its completion, after seven days notice in writing to that effect, the engineer shall readjust or replace at his own expense any part of the plant as may be necessary to render it efficient.

Fire Insurance. The engineer shall insure the whole of his plant and machinery in the joint names of the building owner and engineer for its full value until completion and starting, and shall deposit with the architect the policy and receipts for the premium for such insurance. All moneys received under such policy shall be applied in or towards the replacement of such work destroyed or injured. In case of neglect the building owner is to be at liberty to insure,

and deduct the amount of the premiums paid from any money payable to the engineer.

Mode of Payment. The agreed amount for the machinery, plant, and fixing shall be paid in manner following:—Fifty per cent. of the agreed amount on the delivery of the machinery and plant at the building, a further forty per cent. of the agreed amount on the starting, and the remainder three months afterwards.

What the Plant and Machinery shall comprise. The plant and machinery shall consist of the following, with their connections:—

A belt driven ammonia compressor.
A surface evaporative ammonia condenser.
An air cooler, complete with fan and brine pump.
A water pump.
A Blackman fan.

Ammonia Compressor. The ammonia compressor shall be of the Linde type, horizontal double-acting, and driven by a belt. The barrel shall be of a special mixture of cast iron, truly bored and fitted with a piston with metallic packing rings. The valves shall be of steel, each fitted into a box with seat formed thereon, so arranged that any valve may be readily withdrawn and replaced without disturbing any of the connections. The piston-rod to be of special hard steel, truly turned and polished, secured to the piston and working through special stuffing box in the front cover, the glands arranged to prevent the escape of ammonia. The cross head to be of wrought-iron, and to have slipper with large wearing surfaces, and to be fitted with gun metal bearings.

The connecting-rod to be of polished wrought-iron, fitted with gun-metal bearings at the large end and with steel pin.

The compressor to be securely fixed on, and to include cast-iron bed plate, upon which shall be formed the guide for the cross head and the bearing for the crank shaft.

The crank shaft shall be of steel, fitted with a heavy fly-wheel turned on the rim for driving belt and loose pulley.

Special arrangements shall be supplied for the automatic lubrication of the piston-rod, and to prevent the oil from passing over into the coils of the condenser and refrigerator.

Ammonia Condenser. The ammonia condenser shall be of the surface evaporative type, to consist of a coil of special lap-welded wrought-iron tube wound in one length, coiled in oval shape, all the joints accessible and connected to junction pieces at top and bottom, and with all requisite stays and straps, and fixed over a wrought-iron tank, also supplied by engineer.

Water Pump. Supply for circulating water from the tray over the ammonia condenser coils a belt-driven centrifugal water pump.

Air Cooler. Supply an air cooler of the Linde patent surface cooling type, consisting of coils of special lap-welded wrought-iron tube, each wound in one length to avoid inaccessible joints. Supply all necessary stays and straps and a wrought-iron tray fixed beneath the coil.

Supply in connection with air cooler a brass fitted pump and distributing pieces for circulation of brine, and connect the pump, the tray, and the distributing pieces.

Fan. Supply a belt-driven Blackman fan.

Ammonia Connections. Supply sufficient ammonia connections, including iron pipes, special cocks and valves, steel flanges, bolts and nuts, and the necessary bends, tees, and gauges.

Spare Parts. Supply the following spare and other parts, as follows: One compressor piston rod, one complete set of springs for compressor valves, one complete set of packing screws for compressor gland, all the requisite packing and jointing material for erection and starting, one complete set of spanners, five gallons of compressor oil.

Ammonia and Calcium. Supply a first charge of anhydrous ammonia and calcium chloride for the brine.

Testing. The coils of the condensor and of the refrigerator shall be tested by hydraulic pressure to 2,000 lbs. per square inch, and all other parts of the work exposed to the ammonia to a pressure of 700 lbs. per square inch.

Materials to be supplied by Building Owner. All coal, coke, gas, electric power, and water required during the erection and starting to be supplied by the building owner, together with all masons', bricklayers', excavators', and carpenters' work, driving power, shafting and belts, water connections other than above specified, insulation and lagging, all of which shall be executed in a proper and workmanlike manner, so as to make the premises in every way fit for the reception and working of the plant.

WORK TO BE DONE BY GENERAL CONTRACTOR.

Provisions. Provide the sum of £ for refrigerating plant, to be supplied and fixed by an engineer appointed by the architect.

Provide the sum of £ for electric motors, to be supplied by an engineer appointed by the architect.

Attendances. Attend upon, cut away for, and make good after engineers in fixing refrigerating plant, unload the machinery at railway station, cart it to the building, unload, get into building, and deposit where directed, and efficiently protect it from damage until the completion of the building.

Attend upon, cut away for, and make good after engineers in fixing motors, unload them at the railway station, cart them to the building, unload, get into building, and deposit where directed.

Slag Wool. The silicate cotton shall be obtainad from an approved manufacturer, shall be free from all impurities, and shall be packed to a consistency of 12 lbs. per cubic foot.

Willesden Paper. The waterproof paper shall be P. B. giant insulating paper, list price 24*s*. 8*d*. per roll of 1,000 ft. superficial, supplied by the Standard Paint Co. (39, Victoria Street, S.W.), well lapped at joints, and nailed to the studs or joists with galvanized iron nails.

Matched Boarding. The boarding shall be tongued and grooved, free from knots, and wrought one side. The tongue and groove shall on no account be interrupted, and the wood shall be thoroughly well seasoned first quality St. Petersburg yellow, in 7 in. widths. When there is more than one thickness of boarding the joints of each layer shall be transverse to the other.

Fir. The fir shall be best shippers' mixed Swedish, free from large, loose, or dead knots, thoroughly well seasoned and sawn die-square.

Brown Paper. The brown paper shall be best double imperial dark rope brown, weight 160 lbs. per ream, of sheets 29 in. by 45 in. P. C. 35*s*. per ream.

Flooring. The flooring shall be 1¼ in. in 7 in. widths, grooved and tongued with hardwood cross tongues, laid straight joint with splayed headings.

Walls. The walls shall be finished on the inside with a neatly struck joint as the work proceeds.

Basement Floor. Construct the basement floor of cement concrete, as described, 9 in. thick. Lay thereover Seyssel asphalte, 1 in. thick, in two thicknesses, breaking joint, on cement floated face $\frac{3}{4}$ in. thick. Lay on the asphalte $\frac{3}{4}$ in. grooved and tongued boarding coated with Stockholm tar. Cover with a layer of insulating paper. Lay on this $\frac{3}{4}$ in. grooved and tongued boarding, on this 9 in. by 3 in. joists, 18 in. apart, and finish with $1\frac{1}{4}$ in. tongued and grooved flooring in 7 in. widths. Fill in the spaces between the floor joists with flake charcoal, packed to a consistency of 12 lbs. per cubic foot.

Upper Floors. Construct the upper floors and the ceiling of topmost floors of 9 in. by 3 in. joists, 12 in. apart. Fill in between joists with silicate cotton packed the whole depth of joists. Lay thereon 1 in. grooved and tongued boarding, one layer of insulating paper, one layer of brown paper, $1\frac{1}{4}$ in. grooved and tongued boarding in 7 in. widths.

Nail to the underside of joists, as ceiling, two thicknesses of 1 in. grooved and tongued boarding, with a layer of insulating paper between.

Vertical Insulation. Construct the vertical insulation of 7 in. by $2\frac{1}{2}$ in. studs, 18 in. apart, with 7 in. by $2\frac{1}{2}$ in. heads and sills, and 7 in. by $2\frac{1}{2}$ in. interties, about 2 ft. 6 in. apart, the latter of slightly varied levels, so that the lines shall not be continuous. Cover on each side of studding with two thicknesses of 1 in. wrought one side tongued and grooved boarding in 7 in. widths, and between each two thicknesses of boarding two layers of insulating paper-breaking joint. Fill in between the studs with flake charcoal, packed as before.

Distance Pieces. Block out the studding from the wall by distance pieces, 3 in. by 3 in., and about 4 ft. apart each way.

Ventilate Space behind Insulation. Ventilate the space between the vertical insulation and the wall by heavy ornamental cast iron 9 in. by 3 in. air bricks, 5 ft. apart each way, the openings through the walls rendered with cement.

Air Ducts. Construct the air ducts to detail of 1 in. wrought both sides boarding in as long lengths as possible, tongued together at angles and heading joints, and all put together in white lead. Fit into the internal angles $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. wrought angle fillet, also bedded in white lead. The whole shall be made perfectly airtight.

Hang the horizontal ducts with 4 in. by 2 in. wrought and dovetailed hangers, 4 ft. apart, to the joists of floor.

Construct the vertical air ducts in a similar manner. They shall be continuous for the whole height of the building, passing through the floors without interruption, and carefully connected with the horizontal ducts.

Shutters to Air Ducts.

Form in the horizontal ducts, where shown, openings 10 in. by 14 in. in clear, and supply and fix to each an $1\frac{1}{4}$ in. teak wrought sliding shutter, to run in a groove, top and bottom, formed of $1\frac{3}{8}$ in. by 1 in. teak wrought fillet, with $\frac{3}{4}$ in. by $1\frac{3}{4}$ in. teak chamfered fillet, screwed on, as Fig. 59. Fix in each shutter an $1\frac{1}{2}$ in. screw eye.

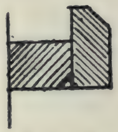


FIG. 59.

Supply for the opening and shutting of shutters $1\frac{1}{2}$ in. turned and diminished ash pole 6 ft. long, with stout wrought-iron pole end fitted thereto, one for each floor.

Trim Floors for Air Ducts.

Carefully trim the floors for the passage of the vertical ducts, so that the trunk may fit closely, and finish around the duct at floor level and ceiling level below with $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. wrought angle fillet, bedded in white lead.

Casing to Stanchions.

Case the steel stanchions with 1 in. wrought deal, tongued at angles with $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. angle fillets fitted to the internal angles, and all put together in white lead. These casings shall be of sufficient size to obtain a thickness of 5 in. of silicate cotton between the steel and the inside of the trunk, and the whole trunk shall be filled with silicate cotton packed to a consistency of 12 lbs. per cubic foot. Finish these casings next floor and ceiling with $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. wrought angle fillet, bedded in white lead.

Casing to Steel Girders.

Cradle the parts of the steel girders which come below the floor with framed cradling of 2 in. deal, and case with 1 in. deal as described for the casing of stanchions Pack with silicate cotton as last described. Finish the junction of casing with ceiling with $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. wrought angle fillet, bedded in white lead.

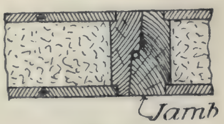


FIG. 60.

Doors.

The doors shall be 3 ft. by 6 ft. (Fig. 60), framed and braced, of 8 in. by 3 in. splayed and splay-rebated stiles and top and bottom rails, 6 in. by 3 in. middle rail and braces. Cover on each side with

1 in. wrought one side boarding in 7 in. widths, grooved and tongued with hardwood tongues and one layer of insulating paper. Pack the space between the two layers of boarding with silicate cotton. Hang to 8 in. by 4 in. splayed and splay-rebated frame with oak sill of similar section with a pair of 30 in. extra strong galvanized iron hook and eye hinges of $2\frac{1}{2}$ in. by $\frac{3}{8}$ in. iron with plates, both hinge and plate screwed with 3 in. stout screws with countersunk heads.

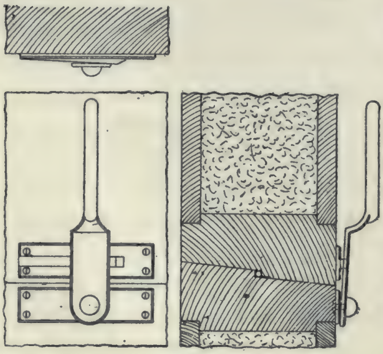


Fig. 61.

Fit each door with two strong galvanized wrought-iron lever fastening (Fig. 61), 14 in. long on plate, and galvanized wrought-iron striking plate with wedge projection, as sketch, and two wrought-iron closing rings. P. C. 2*s*. each.

Fix in the rebate all around on edge of door heaviest india-rubber tube draught excluder.

Rebate the edges of the frame and head to receive the edges of the boarding of insulation.

HEATING OF BUILDINGS.—*See Notes, p.* 564.

See Notes, p. 564.

Specification for Heating the Church of St. Philip, Snodland, Kent.

Provision for Apparatus. Provide for heating apparatus and fixing, to be supplied by John Grundy, 50, Duncan Terrace, City Road, London, £100.

Fix Gratings. Fix the gratings supplied as inlets for cold air, and form openings through external walls, and supply the necessary stone covers. Crank the flues as required, and render them with cement.

Enclosing Wall. Build 9 in. wall to form front of enclosure for heating apparatus.

Cold Air Channels. Connect the chamber with opening in chancel wall by a 12 in. glazed stoneware drainpipe, jointed in cement. Where it lies on the ground it shall have a bed of concrete 12 in. by 6in.; where it passes beneath floor of vestry it shall be suspended therefrom by wrought-iron straps.

Warm Air Channels. Connect the chamber with inlet in floor at western end of nave by a 15 in. drainpipe, part hung up as before.

Connect the chamber of apparatus with warm air outlet in chancel by a 12 in. drainpipe, as before, with that in nave by a 15 in. pipe, no concrete bed to either. Supply all necessary bends, connect the pipes with the pits, and construct proper eyelets in brick rings where the pipes pass through walls.

Pits. Build at each outlet of warm air (two) a brick pit of half brick sides and brick flat bottom, all built and rendered in cement on concrete, 6 in. thick, and connected with the drainpipe. The pits shall be 2 ft. by 2 ft., and 1 ft. 6 in. deep, and 4 ft. by 2 ft. and 2 ft. deep respectively.

Build at western end of nave similar pit 2 ft. by 2 ft. and 2 ft. 6 in. deep. Supply and bed on each pit a 4 in. by 3 in. York curb, rubbed on top, rebated for grating, and bedded and jointed in cement.

Or,

Provision for Apparatus. Provide for Gurney stove and gratings, and delivery at the building, £60.

Unload stove and gratings, get into building, and deposit stove in chamber.

Build the chamber for stove to detail of brickwork in cement. Pave with hardest blue Staffordshire bricks, $2\frac{1}{2}$ in. thick, bedded and jointed in cement, on cement concrete 6 in. thick. Strike the joints of walls fair, and twice limewhite. Connect the fluepipe of the stove with the flue provided.

Pits. Construct in the floor of aisle next each western doorway a brick pit, of half brick sides and brick flat bottom all in cement on concrete 6 in. thick, each 2 ft. 6 in. by 2 ft. by 2 ft. deep. Finish each with $4\frac{1}{2}$ in. by 3 in. York curb, rubbed top and both edges rebated for grating and bedded and jointed with cement.

Channels. Connect each pit with the stove chamber by 12 in. glazed stoneware drainpipe, jointed in cement.

SPECIFICATION OF WORKS REQUIRED TO BE DONE IN SUPPLYING AND ERECTING A HOT-WATER HEATING APPARATUS IN WAREHOUSE AT NEWBURY, BERKS.

Boiler. Supply and fix a best quality "College" boiler, having actual heating capacity 1,000 ft. of surface, with safety valve and emptying cock complete. To be fixed in a pit at the rear of new building as indicated. Carry a pair of 3 in. cast mains from boiler, along beneath ground and road to new building, and continue same along inside wall of basement as far as the centre of back wall. Continue the 3 in. pipes vertically to the floor above, then diminish to 2 in., and on the last floor to $1\frac{1}{2}$ in. Connect and carry horizontal branches along ceiling of basement (as shown on Plan) in $1\frac{1}{2}$ in. wrought steam tube, and on the east side the branch to rise through floor to supply the cast pipes there. Connect and carry $1\frac{1}{2}$ in. horizontal branches in same manner along ceiling of ground floor, also along ceiling of first floor, also second and third floors. On the ground, first, second, and third floors, beneath east windows, supply

Hot Water Pipes.

Hot Water Pipes.

and fix four rows of 4 in. cast pipes, with proper ends and junctions, well supported on cast-iron supports, and connect all to the $1\frac{1}{2}$ in. branches along the ceilings below. All the five sets of $1\frac{1}{2}$ in. ceiling branches to have a pair of gun-metal wheel full-way gate valves of best quality (10 valves), so that every floor can be properly regulated or quite cut out without affecting the regular work of the remainder. All cast pipes to be of Richardson's patent, with expansion joints, and the wrought pipe to be of best quality, tested to 1,000 lbs. per square inch ; a full quantity of air-valves to be put wherever necessary or desirable ; a full quantity of connectors or union pieces to be used for the easy disconnection at any point.

Cold Water Supply.

Connect and run a $\frac{3}{4}$ in. cold supply service from fire main or other convenient point into main return, with best gun-metal full-way gate stop-valve, and supply $1\frac{1}{2}$ in. expansion pipe to apparatus, so arranged that it will not be cut off by the stop valves. All pipes and parts to be soundly supported, or secured with properly made iron brackets or hangers complete.

Exceptions to Heating Engineer's Contract.

The boiler pit.
The chimney for the boiler.
The cutting away and making good.
The trenching and filling in where pipes are underground.
The painting.

General Contractor to supply Plant.

The hot-water fitter to have the free use of trestles or other builder's plant necessary to the execution of the work and that may be on the premises.

SPECIFICATION OF WORKS TO BE DONE IN HEATING BY LOW-PRESSURE HOT WATER A SCHOOL AND CLASSROOMS IN LANT STREET, SOUTHWARK.

What Work Engineer shall do.

The hot-water engineer shall do all the work described in this specification, and shall do all his own cutting away and making good.

Materials to be of the Best Quality.

The materials and workmanship shall be of the best quality procurable of their kind, and the whole shall be done to the entire satisfaction of the architect, whose decision on all matters shall be final, binding, and conclusive.

Time for Completion. The work shall be commenced immediately after signing of contract, and delivered up complete and in working order within three months from the date of commencement. And in case of default the contractor shall pay or allow to the employer as and by way of liquidated and agreed damages, the sum of £5 per week for every week or part of a week during which he shall be so in default.

Testing. The work shall be thoroughly tested at completion, and left clean and in working order, and the contractor shall clear away all rubbish.

Payments. Payment shall be made to the contractor in the following manner: 90 per cent. upon the amount of contract on completion, and the remainder twelve months afterwards.

Maintenance. Any defects of material or workmanship which may appear within twelve months of the completion, shall be made good by the contractor at his own expense.

Contractor shall supply Everything Necessary to Complete. The contractor shall supply everything necessary to complete the work in the best manner, although not specifically mentioned in the specification.

The contractor shall deliver with his tender specimens of the gun-metal valves and air-cocks he proposes to use, 2 in. by 1½ in. and 1¼ in., also a pattern of a pipe clip such as he proposes to use for each of those sizes. These shall remain in the building owner's possession until the work is finished. The specimens belonging to unsuccessful tenderers will be returned to them as soon as the contract is signed.

Cast-iron Pipes. The mains shall be 3 in. cast socketed pipe with red and white lead joint, faced with iron borings cement, an inch boss to be cast on the 3 in. jointed pipe for connecting each flow and return pipe to radiators or coils. Supply the necessary tees, elbows, bends, &c., necessary to complete the work.

Wrought-iron Pipes. The wrought pipes to be Russell's (Wednesbury) best steam tubing, jointed in red lead cement, with all necessary tees, bends, and connections. All barrel to be branded "Steam," and all fittings stamped "Steam." All vertical mains and coils shall be of wrought pipe.

Valves. All cocks and valves shall be of gun-metal polished.

Supply and fix where directed three 3 in. Peet's valves, with all flanges or sockets required.

Supply and fix where directed one 2 in. gun-metal steam valve, with unions each end.

Supply to each syphon coil or radiator one $\frac{1}{4}$ in. barrel air-cock and 1 in. stop valve, with unions at each end.

Supply two 2 in. check valves to regulate flow on first and second floors.

Supply 3 in. valve to control horizontal flow and return mains.

Supply proper keys for valves and air-cocks, two for each size.

Syphons. Supply a syphon at each point marked X on Plan.

Air Pipes. Supply and fix where directed six $\frac{1}{2}$ in. air pipes.

Iron and Lead Collars. Where vertical or horizontal mains pass through floors, ceilings, walls, or woodwork, there shall be supplied a lead collar out of 7 lbs. lead for the vertical mains and a cast-iron collar for the horizontal mains, in both cases of sufficient diameter to allow the pipe to pass freely through.

Boiler. Supply a riveted Trentham boiler of the $\frac{3}{8}$ in. best quality mild steel, and of the following dimensions: Length, 8 ft. internal tube; diameter, 3 ft. 6 in. over all; waterway, 4 in. between plates; mud hole as shown on Plan. Fit with one Galloway tube, riveted to the main plates, and all necessary fittings; 2 in. blow-out pipes connected with drains and fitted with 2 in. gun-metal gland cock; firebox, 3 ft. 6 in. long, with bevel end, firebars and 12 in. dead plate. Contractor to give a written guarantee of the efficiency of this boiler for four years.

Supply cast-iron furnace front with sliding fire and ashpit doors and patent cast-iron air groove furnace expansion bars.

Supply twelve extra firebars, one complete set of stoking tools, comprising two rakes, one clinker bar, one spear head bar, one No. 3 steel shovel, two soot rakes, one 6 in. flue brush.

Set the boiler in the best manner with best material and workmanship, all flues lined with firebrick, set with a close joint in fireclay, the whole well stayed with 2 in. galvanized hoop iron.

Coils. The coils shall be 2 in. pipe coils, rubber jointed. The heating surface of these coils, not including mains, shall

be on the ground floor 8 ft. superficial to 1,000 ft. of cubic space, for the remainder of the building 9 ft.

Supply a round coil and a flat coil in each corridor. The position of the coils is marked on Plans.

Course and Size of Pipes. Carry up from boiler to first floor 3 in. cast-iron main, carry thence up to second floor and along second floor a 2 in. cast wrought main, descending at end class-room, as Plan, down to ground floor, and connected with 3 in. cast main at ground floor level, similar 2 in. branch carried through first floor.

Supply 3 in. cast-iron flow and return in halls, thence supply $1\frac{1}{2}$ in. and $1\frac{1}{4}$ in. wrought pipes to supply the coils on ground, first, and second floors.

Iron Covers. Cover the channels in floors with $\frac{3}{8}$ in. cast-iron chequer plates in convenient lengths for removal, and cut neat holes where required for the passage of rising mains.

Cold Water Supply. Supply and fix in basement a cast-iron feed cistern with ball valve, with copper ball and stem and stop-cock. Carry therefrom 1 in. overflow into nearest area.

Connect feed cistern with boiler by 1 in. pipe with 1 in. stop valve. From cistern over western staircase with 1 in. brass cistern connector with fly nut and union and 1 in. lead pipe lay on the water to feed cistern.

Protect Pipes. Cover all pipes when exposed and not required for warming purposes with Croggon's matted felt bound on with copper wire.

Painting. Paint the radiators and all pipes not felted with two coats of a mixture of gold size and turpentine tinted as shall be directed.

Specification for Boilers, Engine, Fittings, Cold, Hot, and Steam Pipes in the Public Baths and Wash-houses at

George Smith,
Architect,
Russell Square,
November, 1899. London.

Engineer's Work.

Cartage and Delivery of Plant by Building Contractor. The steam boilers, engines, and plant herein described shall be delivered free on rail at the railway station nearest to the

building, the general contractor will unload, cart, unload, get into building, and deposit where directed by the engineer. He will also supply materials and labour for setting the boilers and hoist and fix, and remove rubbish. He will also build the engine bed, but the engineer shall supply skilled superintendence and smiths' and fitters' work.

Pay Royalties. All royalties or patent rights shall be included in the engineer's contract price.

Protect Bright Work. All bright work when fixed shall be painted with white lead and tallow for protection during progress, and at completion or at such time as may be required by the architect the whole of the work shall be cleaned, polished, and left in every respect perfect and in working order.

Time for Completion. The work shall be commenced immediately after signing of contract, and the boilers, engine, and plant shall be set and fixed complete and started in working order within months of the signing of the contract with the engineer. If the engineer fail to complete and start the machinery by the date named he shall pay or allow to the building owner the sum of pounds per week as liquidated and agreed damages for every week beyond the date named, and such damages may be deducted by the building owner from any moneys due to the contractor.

Insure Machinery. The engineer shall insure the whole of his plant and machinery in the joint names of the building owner and engineer for its full value until completion, and shall deposit with the architect the policy and receipts for the premium for such insurance. All money received under such policy shall be applied in or towards the replacement of such work destroyed or injured. In case of neglect, the building owner is to be at liberty to insure and deduct the amount of the premiums paid from any money payable to the engineer.

Payment. The agreed amount for the machinery, boilers, plant, and fixing shall be payable in manner following: 50 per cent. of the contract amount on delivery at the building, a further 40 per cent. of the contract amount on the starting, and the remainder twelve months afterwards; but the second payment shall not be made until the boiler insurance company has certified that the work is satisfactorily done and in working order.

Maintenance. In case of the failure of any part of the work from bad material or workmanship within twelve months of its completion and starting, the engineer shall readjust or replace at his own expense such parts as may be necessary to render it efficient.

Rejection of Work. Any part of the work erected under this contract which does not bear all tests to the satisfaction of the architect shall be rejected and replaced by the engineer at his own expense.

Tests. The whole of the tests shall be conducted entirely at the discretion of the architect in such manner and by such processes as he may consider desirable, and the cost of such testing, whether in fuel, labour, pumps, or other machinery shall be defrayed by the engineer.

The engineer shall, when directed by the architect on at least two occasions before the final starting, fire up the boilers and set the whole machinery and water system in motion for not less than three hours on each occasion, and shall supply a sufficient number of assistants to ensure a perfect starting and running of the whole.

Work shall be of the Best Quality. The whole of the work shall be done in the best and most workmanlike manner, with materials of the best quality procurable, and to the entire approval of the architect in accordance with his directions and the drawings and specifications.

Steel and Iron shall be English. The steel and ironwork shall be of English manufacture, and shall bear the maker's name, and vouchers from the makers shall be produced when required by the architect.

The bolts shall be of the best S. C. crown iron.

Quality of Castings. All castings shall be of the best quality of toughest grey iron of approved brands, they shall be sound, clean, free from sand-cracks, air-holes, and all other defects, and capable of bearing a tensile strain of 9 tons per square inch. Supply all necessary patterns.

Quality of Forgings. The forgings shall be neatly finished, clean, and of iron of the best quality.

Iron Barrel. The wrought tubes and their connections to be James Russell and Sons (Wednesbury), best lap-welded steam quality, galvanized with properly screwed and fitted joints. Supply all tees, bends, angles, and connections as may be required.

Cast-iron Pipes. The cast-iron pipes shall be clean castings, cast vertically, of uniform thickness, and shall weigh the following weights:—

Weight of Cast-iron Pipes.

2 in. diameter,	...	30 lbs.	per yard.
3 in. ,,	...	42 lbs.	,,
4 in. ,,	...	66 lbs.	,,
5 in. ,,	...	87 lbs.	,,
6 in. ,,	...	132 lbs.	,,
9 in. ,,	...	180 lbs.	,,
10 in. ,,	...	264 lbs.	,,

The bends and connections shall be of similar thickness and weight.

Bosses on Pipes. The pipes shall have large bosses cast on to receive the branch pipes.

Pipes shall be Coated. The pipes where laid in the earth shall be coated inside and out with Dr. Angus Smith's solution, the remainder shall be coated inside with the same solution.

Hangers for Pipes. Support the pipes on specially made cast or wrought iron hangers or brackets to detail, the hangers to be secured to the floors, and fitted with screws and plates to regulate the levels.

Joints of Pipes. Carefully face the flanges of the pipes, drill the holes to fit accurately. Supply all bolts and mill-board and joints in red or white lead.

Inspection of Metal Work. The engineer shall make all necessary arrangements to enable the architect to inspect the wrought-iron, steel and other metal, and their workmanship, and shall, if so required, supply prepared specimens of cast-iron, steel or other metal proposed for use.

Verify Dimensions. The dimensions given on the drawings are believed to be correct, but the engineer shall verify them and be responsible for their accuracy.

Boilers. Supply and fix in the boiler-house two double-flued Lancashire boilers of the best quality equal to a working pressure of steam of 100 lbs. per square inch, each 18 ft. long by 6 ft. internal diameter, with two furnace tubes in each. The shell of each boiler shall be of $\frac{1}{2}$ in. Siemens-Martin steel plates in six rings, each ring in one plate, the longitudinal seams shall have butt joints with inside and outside covering straps having four rows of rivets placed

zig-zag. The consecutive seams shall break joint and be free from and above the brick setting. The edges of the plates shall be planed and the joints fullered and not caulked. The annular joints shall be lapped and zig-zag double riveted. All butt straps shall be cut across the grain, and from a large plate.

The rivets shall be of steel, $\frac{11}{16}$ths in. in diameter. The straight pitch of the rivets shall be 3 in., the diagonal pitch $2\frac{1}{2}$ in. The centre line of each row of rivets shall be $1\frac{1}{8}$ in. from the edge of the plate, and all rivet holes shall be drilled after the plates, angles, &c., are bent and placed in position.

No holes to be rimed out or drifted.

The plates shall be tested in accordance with and shall satisfy the rules of the Manchester Steam Users' Association. All plates shall be bent while cold, and shall be planed on their edges.

The flue tubes shall be made in six rings $\frac{3}{8}$ in. thick, each ring in one plate. The longitudinal seams welded solid, and the circular joints made with Adamson's flanged seams with an intermediate web plate. The annular joints of the flues shall not occur in the same vertical planes with each other, or with the annular seams of the shell.

Rivet the ends of the tubes to the end plates of the shell with 3 in. by 3 in. by $\frac{1}{2}$ in. steel angle.

The ends shall be $\frac{9}{16}$ths in. thick, the edges turned in a lathe, and the holes for the flue tubes bored out in the lathe.

The front end plates shall be riveted to solid welded steel angle rings turned on the edges, and double riveted to the shell, the back end plates to be flanged by hydraulic machinery and double riveted to the shell. Stay each end to the shell by ten riveted gusset stays.

Stay each of the end plates with two $1\frac{3}{4}$ in. longitudinal wrought iron stay rods.

Supply each boiler with a circular manhole $16\frac{1}{2}$ in. diameter on top, and one oval manhole in the front plate.

Supply each boiler with riveting bases to receive the fittings. All joint surfaces and nuts shall be faced.

Mountings. Each boiler shall be fitted with the following steam mountings made by Messrs. Hopkinson, of Huddersfield.

One dual safety valve, Fig. 10 in catalogue, for high steam and low water.

One $2\frac{1}{2}$ in. improved dead weight safety valve, Fig. 20 in catalogue.

One 4 in. "Triad" junction valve, Fig. 100 in catalogue, fitted with internal anti-priming pipe.

One 2 in. feed check valve, Fig. 132 in catalogue, with internal pipe 14 ft. long, made up of convenient lengths, screwed together and perforated at rear end with holes $\frac{3}{8}$ in. diameter, aggregating twice the cross area of the feed pipe.

One 2 in. Hopkinson's patent gun metal asbestos packed scum cock, Fig. 260 in catalogue, with cast-iron V scum trough the full length of boiler.

One 2 in. all gun-metal parallel slide blow out valve, Fig. 250 in catalogue, with locking gland and box key.

One 7 in. dial pressure gauge, Fig. 401 in catalogue, graduated to 200 lbs. pressure, with syphon and tap and branch, with cap screwed to receive the tap of a steam engine indicator, or the stem of a standard pressure gauge. Two sets for each boiler of Hopkinson's patent gun-metal "absolute-safety" water gauge, Fig. 644 in catalogue, gland construction, asbestos packed with "reflex" gauge glasses as supplied by Richard Klinger & Co. (66, Fenchurch Street, London), and with Hopkinson's patent safety shields.

One Hopkinson's gun-metal water level, fixed to front plate on approved fusible plug with spare cap for each furnace.

Damper. Supply to each boiler one swivelling cast-iron damper and frame, with levers and rods for working same, extending to front of boiler so that each damper can be worked from the firing floor.

Flue Doors. Fit in front of each boiler two cast-iron flue doors and frames.

Furnace Fronts. Supply two furnace fronts, with doors, provided with hit and miss registers for admission of air, and three $\frac{1}{16}$th in. steam jets over each door, with $\frac{1}{2}$ in. steam connection and valve to boiler, fitted up for smoke prevention.

Dead Plates. Two dead plates and brackets.

Bearing Bars for Furnace. Two sets of bearing bars.

Furnace Bars. One complete set of furnace bars for each furnace.

The furnace bars to be fitted for easy removal. Supply a spare set for each furnace.

Fire Bridges. The fire bridges shall be fireclay blocks, not bricks, set in proper cast-iron bridge frames.

Each fire grate to be 4 ft. 6 in. long from dead plate to bridge, made of two sets of bars each 2 ft. 3 in. long.

Hearth Plates. Supply and fix over the blow-out trench wrought-iron chequered plates $\frac{5}{16}$ths in. thick, rolled flat and cut square at edges, in convenient lengths to remove. The plate opposite to the centre of each boiler and over blow-out valve to be 2 ft. long, and to be provided with a keyhole 4 in. diameter over the key square of the blow-out valve, fitted with a plug resting on a fillet riveted to the underside of plate, and connected to the underside of the plate by a chain.

A key and keyhole to be provided for lifting the plate, These chequered plates to rest at one side on a cast-iron rebated bearer, secured on the wall of the blow-out trench and at the other side on a fillet on a cast-iron fender piece built into the front of the boiler setting.

Stoking Tools. Supply a set of strong stoking tools.

Testing Boilers. Each boiler shall be tested before leaving the works of the maker, and again when in position on its seating, but before being covered in by hydraulic pressure to 200 lbs. per square inch, and again after all mountings and steam pipes have been fixed by hydraulic pressure to the same pressure per square inch, and finally, when complete and in working order, with steam to a working pressure of 100 lbs. per square inch. The test pressures shall be maintained in each case for half an hour, during which time there shall be no sign of weeping at any part.

Painting. Paint the boilers after, but not before inspection at the works of the maker, with two coats of red oxide paint, then when completed and before the non-conducting composition is applied, the paint shall be removed from those parts on which the composition is to be used. When the boilers are completed and in perfect working order after all tests have been applied, paint the fronts with two coats of the best black varnish.

Engine. Supply a Tangye's horizontal steam engine 16-horse power (nominal) with 13 in. cylinder, 24 in. stroke, with variable expansion gear holding down bolts and plates.

Feed Water Heater. Supply Robey's (Lincoln) No. 2 multitubular water heater, of sufficient capacity for a 16-horse power (nominal) engine.

Exhausts. Carry from the feed water heater up through roof $4\frac{1}{2}$ in. cast-iron pipe, with asbestos joints as exhaust. Solder to the flat a 9 in. length of 6 in. lead soil pipe, and bed the exhaust passing through it in white lead.

The exhaust from engine to be 4 in. cast-iron with asbestos joints carried to the feed water heater.

Carry 1 in. wrought-iron pipe from cylinder of engine for a distance of 40 feet as condense.

Connect with the scum cocks of boiler 2 in. wrought-iron pipe as surface blow-off.

Connect with the safety valves of boilers and carry through nearest wall 4 in. cast-iron pipe with asbestos joints.

Connect with blow-off cocks of boilers 3 in. cast-iron pipes, and carry through external wall into area as blow-off pipe.

Steam Mains to Swimming Baths. From main steam pipe lay around swimming baths 4 in. cast-iron steam pipe with asbestos joints.

Injectors. Supply 15 patent gun-metal steam injectors with gun-metal boxes built into the brickwork.

Supply of Steam to Laundries. From main convey steam to public laundry and private laundry by 3 in. cast-iron pipe.

Supply of Steam to Pump. Supply steam to pump by $\frac{3}{4}$ in. wrought-iron tubing, with $\frac{3}{4}$ in. wheel valve.

Supply of Steam to Engine. Supply steam to engine by 3 in. cast-iron pipe with asbestos joints.

Steam Supply to Laundry. From nearest main steam pipe in public laundry, with $1\frac{1}{2}$ in. wrought tube and $\frac{1}{2}$ in. branches, with $\frac{1}{2}$ in. gun-metal steam valves. lay on to each compartment of public laundry.

From nearest main steam pipe, with $1\frac{1}{2}$ in. wrought tube, lay on steam to coils in drying closets.

Coils. Supply in drying closets as shown 4 in. cast-iron pipes, with syphon bends and asbestos joints, to form coils and blank flanges tapped for pipe and supply from nearest main.

Steam Pump. Supply and fix in boiler house on approved cast-iron brackets a Worthington steam pump, with 2 in. wrought tube as suction, carried to condensing tank with 2 in. gun-metal wheel valve.

Connect the feed water heater with the steam pump by 2 in. wrought-iron pipe, with 2 in. gun-metal stop-valve.

Carry from pump 2 in. wrought pipe as exhaust, diminish to 1¼ in., and finish with Royle's patent steam trap.

Hot Water Supply.

Connect the boilers by 6 in. cast-iron steam pipe. Fit with copper flanged expansion joints, and four 4 in. gun-metal wheel valves.

Carry 4 in. cast-iron flow and return from main around each of the swimming baths.

Carry 4 in. cast-iron flow and return around each department of private baths.

Carry 3 in. cast-iron flow and return around public laundry.

From nearest main pipe, with 1¼ in. wrought pipe, 1¼ in. branches, and 1¼ in. gun-metal unions for the valves, lay on the water to each private bath.

From nearest main pipe, with 1½ in. wrought-iron pipe with ¾ in. branch and ¾ in. bib-cocks to each compartment, lay on the water to public laundry.

Cocks and Valves.

All the bib-cocks for cold water shall be Lord Kelvin's patent, gun-metal with screw ferules.

All the stop cocks for cold water shall be of similar manufacture and principle and with gun-metal union at each end.

Fix in every service, as near as possible to its source, a gun-metal stop valve of the best quality.

Supply six 3 in. Hopkinson's best quality diminishing valves marked for various pressures, and fix where hereafter directed.

Pressure Gauges.

Supply six Hopkinson's Bourdon pressure gauges with syphons and stop cocks, and fix where hereafter directed.

Safety Valves.

Supply six 1 in. dead weight safety valves, and fix where hereafter directed.

Overflow from Tank.

From the bottom of tank, with trumpet mouth and 6 in. cast-iron pipe fitted with 6 in. gun-metal valve, carry 6 in. pipe into drain.

Cold Water Service.

From tank about water level carry 4 in. cast-iron pipe into the 6 in. pipe last described, as overflow.

From the cast-iron tank supplied by the building-owners, lay on the water with 3 in. cast-iron flanged pipe to the boilers.

Air Ducts. With 3 in. similar pipe lay on the water from tank to pump. Fit this service with three 3 in. gun-metal screw-down wheel valves.

From tank, with 6 in. pipe, lay on the water to boiler house, with 6 in. branch to each men's swimming bath.

From tank, with 4 in. pipe, lay on the water to women's swimming bath.

From tank, with 4 in. pipe, lay on the water to first class private baths, and from thence with 3 in. pipe to the second class ditto.

From tank, with 3 in. pipe, lay on the water to laundry.

From nearest supply, with 1 in. wrought pipe and 1 in. bib-cocks, lay the water to draw-offs in public laundry and private laundry.

From nearest cast-iron pipe, with $1\frac{1}{4}$ in. wrought pipe with a $\frac{3}{4}$ in. branch and $\frac{3}{4}$ in. bib-cock to each, lay on the water to washing troughs in public laundry and private laundry.

From nearest cast-iron pipe, with $1\frac{1}{4}$ in. wrought pipe, lay on water to the private baths, with short branch and gun-metal union to receive the valves.

From nearest cast-iron pipe, with 1 in. wrought pipe, lay on the water to each shower bath.

With 2 in. wrought pipe, with gun-metal unions, lay on the water to boilers.

With 6 in. cast-iron pipe, 6 in. gun-metal screw-down valve, 6 in. ball-cock and copper ball, lay on the water from company's main to tank.

General Contractor's Work.

Steam Boilers and Engine.

Cartage and Delivery of Engineer's Plant. The boilers and engines will be delivered at the nearest railway station to the building. The general contractor shall unload, cart to the building, unload, deliver, get into building, and deposit in position ready for the engineer. **Set Boiler.** He shall, under the direction of the engineer, supply all labour and materials for the setting of the boilers, and the necessary cutting away and making good, and removing rubbish. This labour and material shall be charged as day account.

Supply Water for Testing. The general contractor shall supply water as required for the starting and testing of the boilers and engine.

Engine Foundation. Build the foundation for the engine of brickwork in cement to detail, with three courses of footings on cement concrete 18 in. thick. Build in the holding-down bolts supplied by the engineer, and run them with cement. Finish the salient angles with blue Staffordshire bull-nosed bricks. Strike the joints of the brickwork as the work proceeds. Supply and bed in cement on the brickwork a 9 in. finely tooled landing of hardest York stone in one piece, with the corners rounded to accord with the angles of the brickwork. Cut the holes for the holding-down bolts as the engineer may direct.

Painting. Paint the whole of the pipes with two coats of Wolston's Torbay paint; the steam, hot, cold, and waste water pipes respectively shall be painted a different and contrasting colour, as shall be directed.

SPECIFICATION OF COMPLETE ELECTRICAL PLANT.—*See Notes, p. 565.*

SPECIFICATION OF ELECTRIC LIGHTING INSTALLATION AND FITTINGS AT FORD HOUSE, KINGHAM, OXFORDSHIRE, FOR GEORGE GORDON, ESQ.

JAMES THOMPSON,
Architect,
Chipping Norton,
January, 1899. Oxfordshire.

Work to be done to the Satisfaction of the Architect. The work shall be carried out in accordance with the directions and to the satisfaction of the architect, and in accordance with the drawings and specifications, and such other drawings, details, and instructions as may from time to time be given by the architect.

Drawings and Specification. One copy of the drawings and specification shall be furnished by the architect for the contractor's own use. The contractor shall keep on the work until its completion a copy of the plans and specifications, and such apparatus as may be necessary for testing the work.

Contractor shall furnish Priced Copy of his Estimate. The contractor shall, immediately after the signing of the contract, deposit with the architect a fully priced copy of his original estimate in detail, moneyed out and cast.

Contractor shall supply Everything Necessary to Complete. The contractor shall supply everything necessary for the proper execution of the works, according to the true intent and meaning of the drawing and specification taken together, whether the same may or may not be particularly shown on the drawings or described in the specification; provided that the same is reasonably to be inferred therefrom. Figured dimensions are to be followed in preference to scale.

Testing. The contractor shall, at such times as the architect may direct, effectually test the work, and shall leave it in such effective condition as shall satisfy the architect.

Work to the Satisfaction of Fire Office, &c.

The whole of the work shall be carried out, arranged and completed to the satisfaction of the surveyor of the Fire Office in which the building is insured, and shall not transgress any of the Phœnix Fire Office rules for electric light installations.

Contractor shall Amend Errors.

The contractor shall, during the progress of the work, amend at his own cost any errors arising from inaccurate setting out, or his mistaken interpretation of the specification.

Contractor to Furnish Vouchers.

All materials and workmanship shall be of the respective kinds described in the specification, and the contractor shall, upon the request of the architect, furnish him with vouchers to prove that the materials are such as are specified.

Contractor shall keep Foreman on the Premises.

The contractor shall keep constantly on the works a competent general foreman, and any general directions or explanations given by the architect to such foreman shall be held to have been given to the contractor.

Contractor shall Dismiss Objectionable Workmen.

The contractor shall, on the request of the architect, immediately dismiss from the works any person employed thereon by him who may, in the opinion of the architect, be incompetent, or misconduct himself; and such person shall not be again employed on the works without the permission of the architect.

Variations shall not Vitiate the Contract.

No variation shall vitiate the contract. All additions, omissions, or variations made in carrying out the works, for which a price may not have been previously agreed upon, shall be measured and valued, and added to or deducted from the amount of contract as the case may be, according to the prices of the original estimate, or where these may not exactly apply, at analogous rates.

Materials shall be the Property of Employer.

When the contractor shall have received payment of any certificate in which the architect shall have stated that he has taken into account the value of any unfixed materials intended for the works, and placed by the contractor thereon, all such materials shall become the property of the employer, and shall not be taken away except for the purpose of being used on the building without the written authority of the architect, and the contractor shall be liable for any loss or damage to such materials.

Architect may Order the Removal of Materials.

The architect shall, during the progress of the works, have power to order in writing, from time to time, the removal from the works within such reasonable time or times as may be specified in the order, of any materials which, in the opinion of the architect, are not in accordance with the specification or the instructions of the architect, the substitution of proper materials, and the removal and proper re-execution of any work executed with materials or workmanship not in accordance with the drawings and specification or instructions; and the contractor shall forthwith carry out such order at his own cost. In case of default on the part of the contractor to carry out such order, the employer shall have power to employ and pay other persons to carry out the same, and all expenses consequent thereon or incidental thereto shall be borne by the contractor, and shall be recoverable from him by the employer, or may be deducted by him from any moneys due, or that may become due to him.

The Contractor shall Amend Defective Work.

Any defects, shrinkage, or other faults, or any defect, electrical or mechanical, which may appear within twelve months from the completion of the works, arising in the opinion of the architect from materials or workmanship not in accordance with the drawings and specification, or the instructions of the architect, shall upon the directions in writing of the architect, and within such reasonable time as shall be specified therein, be amended and made good by the contractor at his own cost, unless the architect shall decide that he ought to be paid for the same, and in case of default the employer may employ and pay other persons to amend and make good such defects, shrinkage, or other faults or damage, and all expenses consequent thereon, or incidental thereto, shall be borne by the contractor, and shall be recoverable from him by the employer, or may be deducted by him from any moneys due, or that may become due to the contractor.

Contractor shall not Assign Contract.

The contractor shall not, without the written consent of the architect, assign this agreement, or sublet any portion of the works.

The Contractor shall be Responsible for Damage.

The contractor shall be responsible for all structural and decorative damage to property, and for injury caused by the works or workmen to persons, animals,

or things, and shall hold the employer harmless in respect thereof.

Time. Possession of the premises shall be given to the contractor on or before the day of . He shall begin the works immediately after such possession, shall regularly proceed with them, and shall complete the same by the day of , subject, nevertheless, to the provisions for extension of time hereinafter contained.

Penalty. If the contractor fail to complete the works by the date named in clause or within any extended time allowed by the architect under these presents, and the architect shall certify in writing that the works could reasonably have been completed by the said date, or within the said extended time, the contractor shall pay, or allow to the employer the sum of £ sterling per day as liquidated and ascertained damages for every day beyond the said date, as the case may be, during which the works shall remain unfinished, except as provided by clause as to time, and such damages may be deducted by the employer from any moneys due to the contractor.

Employer may Take Possession. If the contractor shall suspend the works or, in the opinion of the architect, shall neglect or fail to proceed with due diligence in the performance of his part of the contract, or if he shall more than once make default in the respects mentioned, the employer, by the architect, shall have power to give notice in writing to the contractor requiring that the works be proceeded with in a reasonable manner and with reasonable despatch.

If the contractor shall fail for seven days after such notice has been given to proceed with the works as therein prescribed, the employer may enter upon and take possession of the works and site and of all such plant and materials thereon (or on any ground contiguous thereto) intended to be used for the works, and all such materials as above mentioned shall thereupon become the property of the employer absolutely, and the employer shall retain and hold a lien upon all such plant until the works shall have been completed under the powers hereinafter conferred upon him. If the employer shall exercise the above power he may engage any other person to complete the works, and exclude the contractor, his agents, and servants from

Employer may Take Possession.

entry upon or access to the same, except that the contractor or any one person nominated by him may have access at all reasonable times to inspect, survey, and measure the works. And the employer shall take such steps as in the opinion of the architect may be reasonably necessary for completing the works without undue delay or expense, using for that purpose the plant and materials above mentioned in so far as they are suitable and adapted to such use. Upon the completion of the works the architect shall certify the amount of the expenses properly incurred consequent on and incidental to the default of the contractor as aforesaid and in completing the works by other persons. Should the amount so certified as the expenses properly incurred be less than the amount which would have been due to the contractor upon the completion of the works by him, the difference shall be paid to the contractor by the employer; should the amount of the former exceed the latter, the difference shall be paid by the contractor to the employer. The employer shall not be liable to make any further payment or compensation to the contractor for or on account of the proper use of the plant for the completion of the works under the provisions hereinbefore contained other than such payment as is included in the contract price. After the works shall have been so completed by persons other than the contractor under the provisions hereinbefore contained, the employer shall give notice to the contractor of such completion, and may require him from time to time before and after such completion to remove his plant and all such materials as aforesaid as may not have been used in the completion of the works from the site. If such plant and materials are not removed within a reasonable time after notice shall have been given, the employer may remove and sell the same, holding the proceeds, less the cost of removal and sale, to the credit of the contractor. Any notice to be given to the contractor under this clause shall be given by leaving the same at the place of business of the contractor or by registered letter sent to him at that address.

Definition of Prime Cost.

The words "Prime Cost" or the initials "P. C." applied in the specification to goods to be obtained and fixed by the

contractor, shall mean, unless otherwise stated in the specification, the sum paid to the merchant after deducting all trade discount for such goods in the ordinary course of delivery, but not deducting discount for cash, and such sum shall be exclusive of special carriage, the cost of fixing, and contractor's profit.

Payments. The contractor shall be entitled under the certificates to be issued by the architect to the contractor, and within days of the date of each certificate, to payment by the employer from time to time by instalments when, in the opinion of the architect, work to the value of £ (or less, at the reasonable discretion of the architect) has been executed in accordance with the contract at the rate of per cent. of the value of work so executed in the building until the balance retained in hand amounts to £ , after which time the instalments shall be up to the full value of the work subsequently executed. The contractor shall be entitled under the certificate to be issued by the architect, to receive £ , part of the said sum of £ , when the works are practically completed, and in like manner to payment of the balance within a further period of twelve months or as soon after the expiration of such period of twelve months as the works shall have been finally completed and all defects made good according to the true intent and meaning hereof whichever shall last happen. The architect shall issue his certificates in accordance with this clause. No certificate of the architect shall be considered conclusive evidence as to the sufficiency of any work or materials to which it relates, nor shall it relieve the contractor from his liability to make good all defects as provided by this agreement. The contractor when applying for certificates shall, if required, as far as practicable, furnish to the architect an approximate statement of the work executed based on the original estimate.

Contractor may Determine Contract. Should the employer not pay the contractor any sum certified by the architect within the times respectively before named the contractor shall give written notice to the employer of the non-payment, and should the employer not pay any such sum within the period of days from the date of delivery of such notice at the employer's

Contractor may Determine Contract. address, or sent to him there in the ordinary course of post by registered letter, or if the employer shall become bankrupt or file any petition for liquidation of his affairs, and if his trustee in bankruptcy shall repudiate this contract, or if the trustee shall be unable to show within days to the reasonable satisfaction of the contractor his ability to carry out the contract and to make all payments due or to become due thereunder, or if the works be stopped for months under an order of the architect or any Court of Law, the contractor shall be at liberty to determine the contract by notice in writing to the architect and to recover from the employer payment for all work executed and for any loss he may sustain upon any plant or material supplied or purchased or prepared for the purpose of the contract. In arriving at the amount of such payment the rates contained in the contractor's original estimate shall be followed, or, where the same may not apply, rates proportionate to the prices therein contained.

Arbitration. Provided always that in case any dispute or difference shall arise between the employer or the architect on his behalf and the contractor, either during the progress of the works or after the determination, abandonment, or breach of the contract as to the construction of the contract or as to any matter or thing arising thereunder (except as to the matters left to the sole discretion of the architect, or as to the withholding by the architect of any certificate to which the contractors may claim to be entitled), then either party shall forthwith give to the other notice of such dispute or difference, and such dispute or difference shall be and is hereby referred to the arbitration and final decision of or, in the event of his death or unwillingness or inability to act, of and the award of such arbitrator shall be final and binding on the parties. Such reference, except on the question of certificate, shall not be opened until after the completion or alleged completion of the works, unless with the written consent of the employer or architect and the contractor. The arbitrator shall have power to open up, review and revise any certificate, opinion, decision, requisition, or notice, save in regard to the said matters expressly excepted above, and to determine all matters in dispute

Arbitration. which shall be submitted to him and of which notice shall have been given as aforesaid in the same manner as if no such certificate, opinion, decision, requisition, or notice had been given. Upon every or any such reference the costs of and incidental to the reference and award respectively shall be in the discretion of the arbitrator, who may determine the amount thereof or direct the same to be taxed as between solicitor and client or as between party and party, and shall direct by whom and to whom and in what manner the same shall be borne and paid. This submission shall be deemed to be a submission to arbitration within the meaning of the Arbitration Act, 1889.

General.

Workmen. All the work shall be done by workmen of approved competence and none shall be done by task work.

Position of Points. The position of the points to be wired is shown thus X on the plans, and should the architect desire to alter the position of any light so shown, the contractor shall alter it without extra charge, so long as it does not involve the doing of the work a second time.

Sketches and Samples. Details to scale of the switch and fuse boards, and samples of any of the materials and articles to be used in the work shall be submitted to the architect when required, and the invoices shall be produced at the settlement of the accounts.

Scaffold, &c. The contractor shall supply his own ladders, trestles, scaffolding, and plant, and shall do his own cutting away, but the general contractor will make good. Any wanton or wasteful cutting away or avoidable damage shall be made good by the electric lighting contractor, he shall give notice and arrange with the architect or general contractor's foreman, the course of the wires or casings and the position of the holes or chases he proposes to cut, and they shall be subject to the architect's approval. As much as possible of the electrician's work shall be done before the plastering is commenced.

Casings. The casings generally shall be hard, well seasoned

Casings. American white wood of the best quality, free from knots, shakes, and all other defects, and shall be varnished inside with best shellac varnish, and painted two coats outside.

The casings shall in all cases be fixed with brass cups and screws. The capping shall be screwed on to the sides, and for the broader casings 9 in. wide or over, shall be screwed along the centre.

Each conductor shall be placed in a separate groove. The grooves 1 in. apart for sub-mains, &c., $\frac{3}{4}$ in. apart for the remainder. The casings shall be run in positions where they cannot be affected by damp.

Wooden casings shall be used in the basement and on topmost floor.

Throughout the building, except in basement and topmost floor, the wiring shall be run in the Conduit and Insulation Co.'s (63 Queen Victoria Street, London) steel armoured insulation conduit, as a general rule chased into the walls. They shall be of sufficient size to prevent injury to the insulation of the conductors when drawn in. Both conductors shall be drawn into one tube, and there shall be no joint in the pipe between any two accessible points.

Supply junction boxes at all junctions of the best shape for the purpose, and inspection bends at all bends, and carefully joint the pipes.

The pipes and casings shall be so arranged as to be easy of access, especially the joints of the pipes.

Where possible, after conductors are drawn into position, the tubes shall be filled with clean dry sand.

Wiring. The whole of the materials and apparatus, except the lamps, shall be suitable for a 200 volt supply.

Cables and Leads. The mains and leads shall be of soft tinned copper, tinned before stranding, of a conductivity of 98% of pure copper, insulated with pure vulcanized indiarubber, braided and taped and covered with a preservative solution.

Flexible wire shall not be used for wiring fittings, unless it be covered with vulcanized indiarubber.

The insulation of all conductors shall be not less than 600 megohms per mile, and for the underground work 2,000 megohms.

Cables and Leads. The whole of the cables and leads shall be of the best quality, and shall be made by a manufacturer to be approved by the architect.

No wire less than $\frac{3}{22}$ shall be used, and where a separate cut-out is not used, a $\frac{7}{21\frac{1}{2}}$ wire shall be brought up to the lighting point. All conductors larger than $\frac{1}{18}$ shall be stranded.

All the joints must be easily accessible, the joints shall be soldered with resin as a flux. The covering shall be cut back, and the surface of the copper cleaned. Cover the joints with pure indiarubber tape and rubber solution. Cover with prepared tape and varnish.

There shall be no "bunching" of conductors together.

Carry from the cut-out boards on each floor branch circuits, which shall not exceed 5 ampères each, and of such section that the drop in E. M. F. between any cut-out board, and the farthest lamp on the circuit shall not exceed 1 volt when all are in use.

Fuses. Wherever the section of a conductor is reduced, a double pole fuse shall be fixed. The kind of fuse shall be approved by the architect.

Switches. All switches shall be fire proof, with substantial rubbing contacts, and of quick make and break type, so that they cannot remain in any position between on and off.

They shall be mounted on incombustible bases fixed to polished wood blocks.

All switches for rooms to be placed at the entrance, and preferably on the lock side of the doorway.

All switches and fittings shall be mounted on teak French polished turned blocks.

Flexible Leads. The ends of all flexible twin wires shall be tinned before connection with any switch, cut out wall plug, or lamp holder.

Wall Plugs. Supply teak wall blocks of approved make for building in (to receive the polished ones). All these blocks shall be cut away sufficiently to allow the wires to be easily drawn in or out of position without straining the insulation.

Ceiling Plates. The ceiling plates shall have incombustible bases fixed to polished wood blocks, with a cut-out on one pole, and shall have a screw cover and approved cord grip.

Fuses. All wall and floor sockets shall be fitted with a fuse in the detachable portion only.

Lamps. The B. C. Ediswan 100 volt lamps for all the flexible pendants and plain brackets in the schedule shall be supplied by contractor, who shall make good any lamps broken or found defective during the progress of the work and the testing, and they shall be left perfect and in working order at completion.

The wires shall be drawn into the pipes after the plastering is done.

Colour of Positive and Negative Leads. All positive leads shall be red, negative leads black.

Switch and Cut-out Boards. The switch and cut-out boards shall be of 1¼ in. Valentia slate, rubbed, sanded, and enamelled both sides. The positive and negative portions completely insulated, and all connections so arranged as to be made from the front of the boards.

Fix 3 in. by 1½ in. teak fillets plugged to walls all around the edge of the board, and screw the board thereto with stout screws with ebonite rings and collars.

Fix on ground floor an eight way distributing switch board with switches and fuses on all poles.

Enclose each switch board and the distributing switch board in a case of teak French polished inside and out of 1¼ in. rims, secret dovetailed at angles, with 1¼ in., one panel door hung with 3 in. brass butts, rebated for glass with moulded beads, and glazed with British polished plate of the best glazing quality bedded in indiarubber. Fit each door with a brass lock. P. C. 4*s*.

Fix on each floor where directed a switch board as described. Carry thereto from the distributing switch board sub-mains of sections as follows:—

Ground floor	19/18
First floor	19/18
Second floor	19/17
Third floor	19/17
Basement	19/16

Fittings. Provide for fittings £ , and allow for packing carriage and profit for the fixing. See list of points.

List of Fittings.

Wire for and fix the following fittings in the positions marked on plans.

BASEMENT.

Position.	No. of Points.	Description.	Switches.
Area brushing room	1	Bracket, P. C.	1
Gas meter room	1	,, ,,	1
Servants' w.c.	1	,, ,,	1
Butler's bedroom	1	,, ,,	1
Store adjoining	1	Pendant, P. C.	1
Housekeeper's room	2	2 Pendants, P. C. each	2
Corridor adjoining	4	2 Pendants, P. C. each 2 Brackets, P. C. each	2 2
Wine cellar	2	2 Brackets, P. C. each	1
Servants' hall	3	3 ,, P. C. each	3
Staircase and lift	3	1 Pendant, 2 Brackets, P. C. each	3
Butler's pantry	2	2 Brackets, P. C. each	2
Strong room	1	1 Bracket, P. C.	1
Footman's bedroom	1	1 Pendant, P. C.	1
Spare room	1	1 ,, ,,	1
Still room	1	1 ,, ,,	1
Larder	2	1 Pendant, P. C. 1 Bracket, P. C.	2
Yard w.c.	1	1 Bracket, P. C.	1
Two stores	2	2 Pendants, P. C. each	2
Scullery	2	2 Brackets, P. C. each	2
Kitchen	2 2	2 Pendants, P. C. each 2 Brackets	2 2
Housekeeper's bedroom	1	1 Pendant	1
Maid's bedroom adjoining	1	1 ,,	1

GROUND FLOOR.

Portico	1	Pendant, P. C.	1
Vestibule	1	Two-light Bracket, P. C.	1
Stairs to basement	1	Bracket, P.C.	1
Entrance hall	1	Two-light Bracket, P. C.	1
Principal stairs (half landing)	2	2 Wall sockets	2
Cloak-room	1	Pendant, P. C.	1
Library mantel-piece	2	2 two-light Brackets	2
Library	3	3 Brackets, P. C. each	1
Dining-room	9	9 ,, ,,	4
Servery	3	3 ,, ,,	3
Billiard-room	6	6 ,, ,,	6

FIRST FLOOR.

Principal landing	1	Pendant, P. C.	1
Front drawing-room	4	Two-light Brackets, P. C. each	4

Fittings.

First Floor—*continued.*

Position.	No. of Points.	Description.	Switches.
Back drawing-room	5	5 Brackets, P. C. each	5
Two master switches, for controlling all lights in both drawing-rooms, shall be fixed in a box on principal landing.			
Boudoir	2	2 Brackets, P. C. each	2

SECOND FLOOR.

Position.	No. of Points.	Description.	Switches.
Landing	2	2 Brackets, P. C. each	2
Bedroom 1.	2	2 Pendants over dressing table, P. C. each	1
Bedroom 2.	2	2 Pendants over dressing table, P. C. each	1
	1	Pendant over bed with pear switch, P. C.	1

&c.

Engine and Boiler. Supply in engine-house a Robey & Co. (Lincoln) 8 horse-power (nominal) double cylinder, class D vertical steam engine and cross-tube boiler on a strong water-heater tank as base plate, the engine to have heavy gun-metal bearings of standard pattern, variable expansion gear, steel piston rod, slide rod and pins, feed pump of improved construction, and high speed governor. The boiler of best steel plates tested to 150 lbs. per square inch, and lagged in a satisfactory manner.

The whole to be fitted with 1 in. bolts and securely bolted to the foundation prepared by general contractor.

Dynamo. Supply and fix with 1 in. bolts to the foundations prepared by the general contractor, a three-unit continuous current dynamo, shunt series with slide rails and self-oiling bearings.

Accumulators. Supply a battery of 55 accumulators, K. I. type, in glass boxes, with wooden trays and glass insulators, and an Ediswan accumulator switch-board of sufficient size with Neville automatic cut-out, and oak frame.

Charge Accumulators. Supply one charge of acid for the accumulators, and leave in working order.

SPECIFICATION OF ELECTRIC INSTALLATION FOR SUPPLY OF ALTERNATING CURRENT BY A PUBLIC COMPANY.

SPECIFICATION FOR ELECTRIC LIGHTING OF THE TECHNICAL COLLEGE, CAMBERWELL.

JOHN BROWN,
Architect,
Denmark Hill.

October, 1899.

Sub-letting of Contract. The contractor shall not sub-let or assign his contract, nor any part thereof without previously obtaining the consent in writing of the architect, and in the event of a breach of this condition he must pay or forfeit to the building owner by way of liquidated damages a sum equal to 5 per cent. on the total amount of any sub-contract or assignment he may enter into.

Omissions. Notwithstanding the omission from the specification or drawings of any plant or material that may be requisite, the contractor shall supply and erect the same so as to leave the work under that section of the specification in good and complete working order.

Contractor to Inform Himself Fully. Should there be any doubt or obscurity as to the meaning of any portion of the specification, the contractor must set forth the particulars thereof and submit them to the architect in order that such doubt or obscurity may be removed before the signing of the contract. If any misunderstanding should arise during the progress of the works the decision of the architect as to the meaning of any dimensions, clause, word, sentence, or otherwise, must be taken as final.

Date of Completion. The work shall be completed and ready to test on or before the expiration of ten weeks from the date of the contract.

Penalty for Delay in Completion.

In case the contractor shall fail in the due performing of his contract by and at the time hereinbefore mentioned or referred to he shall be liable to pay to the committee as and for agreed liquidated damages 10*s*. per cent. of the gross value of his contract for each and every day which may have elapsed between the appointed time and the actual time of completion hereinbefore mentioned and provided for, and the vestry may deduct the same from any moneys in their hands, due or to become due to the contractor.

Manner of Execution, Quality of Material, &c.

The work is to be executed and completed in accordance with the said contract, tender, specification, plans, sections and drawings, and these general conditions, in the best and most substantial and workmanlike manner, with materials of the best and most approved qualities of their respective kinds, and shall be carried out strictly in accordance with the lighting company's wiring rules, the rules of the Royal Exchange Insurance Company, and the regulations of the Board of Trade and the London County Council.

Engineer's Superintendence.

The work is to be carried out to the entire satisfaction of the architect, but no plea as to the acts, order, or general supervision of the architect will be admitted in justification of any errors of construction or fixing. The whole of the work must also conform to all requirements of the electrical engineer to the lighting company.

Contractor's Superintendence and Foreman.

The contractor shall constantly employ one competent foreman to be kept on the premises during all working hours to superintend the work and to receive from time to time all orders and instructions from the architect as he may see fit to give, and such foreman, in the absence of the contractor, shall be considered as his legal representative in and about the premises, and shall have full power to make any deviations or alterations in the work as the architect may consider not to have been provided, erected, executed, constructed, and completed in accordance with the contract, tender, specification, plans, sections, drawings and these general conditions, or any part thereof respectively.

Foreman and Workmen.

The said foreman, if objected to by the architect, shall be removed by the contractor, and the contractor shall within forty-eight hours after receiving formal objection in writing, replace him with another competent foreman. The architect shall also be at full liberty to object to any person

employed by the contractor in the execution of the work who shall, in the opinion of the architect, misconduct himself, or be incompetent or negligent, and the contractor must at once remove the person so objected to.

Power to Vary Work.

The contractor shall not alter in any way whatsoever any of the work except as directed by the architect or the electrical engineer to the lighting company, but either shall have full power to alter, amend, or otherwise vary any of the work (without in any way affecting or vitiating the contract), and the contractor shall carry out such alterations and amendments, and be bound by the same conditions as though the said alterations were part of the original specification and contract. The difference of expense occasioned by such alterations or amendments shall be ascertained in accordance with the prices attached to the tender, and be added to or deducted from the contract price; and where the rates are not contained in the prices attached to the tender, the architect shall ascertain the amount of such additions or deductions, and his valuation thereof shall be accepted by the contractor, and the building owner shall not become liable for the payment of any charge in respect of any such alterations or amendments unless the instruction for the performance of the same shall have been given in writing by the architect, nor unless such instruction shall distinctly state that the matter thereof is to be the subject of an extra or varied charge, nor unless the particulars of his claim shall be set forth in writing by the contractor and furnished to the building owner by the end of the month in which the alterations or amendments are completed. The non-delivery of such particulars of claim at the proper and stated time will be considered as the abandonment of any claim for the value of such alterations or amendments, and as exonerating the building owner from all liability relating thereto, but the building owner shall be bound by such particulars unless he objects thereto within three calendar months after delivery thereof.

Materials Brought on to the Site.

The building owner will not be held responsible for the loss or injury of any of the contractor's plant, materials, tools, tackle, or other things whatsoever.

If in the opinion of the architect the contractor fails to execute the work with due diligence and expedition, or shall

Negligence, &c. refuse or neglect to comply with any orders given him by the architect, or shall fail to execute any other matter stipulated in the contract, or shall contravene the provisions of the contract, the building owner shall, after seven days' notice to the contractor in writing, signed by the building owner, be at liberty to employ other workmen, and forthwith perform such works as the contractor may have failed to do. Or if the building owner shall think fit, it shall be lawful for him to take the works wholly or in part, out of the contractor's hands, and recontract with any other person or persons, or provide any other tools, materials, or labour for the purpose of completing the work, or any part thereof, and the building owner shall have the free use of all the plant, materials, tools, tackle, or other things which may be on the premises or in use at any time to the exclusion of any right of the contractor over the same, and all expenses, costs and charges which may be incurred by the building owner in the performance or completion of such works as aforesaid shall be deducted from any moneys due to the contractor, but when all expenses, costs and charges incurred in the completion of the work are paid, all such plant, material, tools, tackle and other things, shall be removed by the contractor.

Bankruptcy. Like powers to those set forth in the preceding clause shall be enforced if the contractor die, become insolvent, or have a receiving order made against him, or assigns his contract.

Replacement of Defective Work or Materials. Should the architect consider that the contractor has executed any unsound or imperfect work, or has supplied any materials of inferior quality to those specified, the contractor shall, at his own expense, within forty-eight hours of his receiving notice thereof from the architect, proceed to alter, pull down, or remove such work or materials, and shall immediately rectify or reconstruct the same, or supply fresh material up to the standard of the specification, and in case the contractor shall fail to comply with such orders, the building owner may without further notice remove the work or material complained of, and at the cost of the contractor perform all such work or supply all such materials. The contractor must not cover or in any way conceal work until it has been formally approved by the architect,

otherwise he shall be required to re-open the same at his own expense.

Final Tests. Before the building owner takes over the work, or at such other time, not being later than three calendar months after such taking over, as shall be desired by the architect, and on the architect giving one week's notice in writing, the contractor shall make all necessary insulation and other tests at his own cost, either together or in sections at the option and in the presence of the architect, and in all respects in accordance with and in manner provided by the specification, and shall find and provide all necessary apparatus and instruments for that purpose, and if in the opinion of the architect any defects shall appear, the same shall be made good by and at the cost of the contractor, after which a new test shall be carried out upon the same terms and conditions.

Total Rejection of Inefficient Work. If any completed work or part of work fail to pass the standard of test specified, the architect may totally reject such work or part of work, and the contractor shall submit to a deduction being made from his contract price according to the estimate of the architect in respect to such rejected work, the intention being that it shall be lawful for the building owner to obtain without additional cost the particular work from another party, if the contractor shall fail to carry out any work or part of work in strict accordance with the specification.

The contractor will be required, at the completion of the work, to set out on outline plans to be supplied by the architect, the sizes and positions of all pipes, wiring, and other work done under the contract, and to accompany these plans by a complete schedule of the lights and fittings.

Liability for Accidents. The building owner will not be responsible for any damage that may occur to the contractor's tools, materials, or work due to fire or other cause not being the wilful act of his servants.

Patent Rights. The contractor shall fully indemnify the building owner against any action or loss sustained owing to any infringement of patent rights, real or alleged, through any materials supplied or work done by the contractor. All royalties due or payable on account of any patents covering any portion

or portions of the plant supplied shall be included by the contractor in his tender, and be paid by him to those to whom they may be due or payable.

Notices. All notices to the contractor for the purposes of the contract and these general conditions shall be sufficiently authenticated if signed by the architect, and may be served upon the foreman of the contractor herein referred to, or may be forwarded by post by a prepaid letter addressed to the contractor by name at his last known or usual place of business or abode in the United Kingdom, and any notice so forwarded by post shall be deemed to have been duly served upon the contractor at the time when the letter containing the same would be delivered in the ordinary course of post, and in proving such service it shall be sufficient to prove that the notice was properly addressed and posted.

Terms of Payment. Within one month after the completion of the work to the satisfaction of the architect, the building owner shall pay to the contractor 80 per cent. of the amount due; the balance of 20 per cent. shall be paid by the building owner to the contractor within three months after the current is laid on, provided the architect is satisfied that there is no defect in the work.

Future Extensions. The contractor shall, if required by the building owner, supply at any time within three years from the date of the contract, similar appliances to those supplied by him under the contract at the same rate of charge as herein quoted.

Arbitration. In case any dispute or difference whatsoever shall at any time or times hereafter arise or exist between the contractor and the building owner touching their respective rights or obligations under the said contract, or the fulfilment or non-fulfilment thereof or incident thereto, except as to such matters as are to be referred to or decided by the architect as hereinbefore mentioned, such dispute or difference shall from time to time, at the instance of or request of either party, be decided by arbitration under the provisions of the Arbitration Act, 1889.

All work is to be proceeded with as directed by the architect, and is to be carried on in such manner and at such times as not in any way to impede or hinder the proper use of any portion of the building.

Selection of Contractor. From those tendering, a selection of not less than two or more than four shall be made by the building owner, each of whom will be required to submit a complete set of

Samples. samples of all articles tendered for, and in the case of those articles of which this may not be practicable, the parties are to submit drawings to an approved scale, and to state where similar articles may be seen showing workmanship guaranteed of the articles they propose to supply, but samples will be required of—

Painted blocks and impregnated hardwood blocks.
Iron barrel of the different sizes.
Junction boxes.
Clips for fixing barrels.
Couplings for barrels.
All bends and T's for barrels.
Switch-boards and fuse-boards.
Brackets, standards, pendants, and electroliers.
Six in. lengths of wire and cable of the larger, and 12 in. lengths of the smaller sizes.
Insulated joints in ditto.
Switches, including those for main switch-board.

Cutting Away and Making Good. The contractor is to do all necessary cutting away of woodwork, taking up floors, making roads through joists, partitions, walls, &c., making all necessary chases, cutting away of brickwork, concrete, stonework, and the making good of same in the most approved manner and to the complete satisfaction of the architect. All cutting away and making good to the building, whether specially mentioned hereafter or not, in all and every trade is to be done in the most careful and substantial manner, and any work which has been cut away unnecessarily, or in an unworkmanlike manner, or which has been required, owing to proper instruction not having been given in time, shall be made good by the contractor for this work, and no extra charge is to be made for any such work requisite for the perfect completion of this installation.

A copy of the lighting company's wiring rules is supplied with this specification, and also a schedule of the lamps.

The contractor shall submit with his tender a schedule of prices, on the basis of which prices the committee may

Schedule of Prices. order work as an addition to or deduction from that in the specification. The contractor is also required to state in such schedule the extra charge per light for wiring any additional 16 c. p. lamp which may be required. This latter charge is to include the necessary switches, cut-outs, blocks and ceiling roses. It is also required to be stated what reduction will be made for wiring each lamp shown upon the plans which it may be decided to dispense with, provided always, however, that the wiring of extra lamps in one position shall be set against the wiring of lamps not required in another position.

Contractor to take his own Dimensions. The contractor is to take all dimensions and particulars from the actual buildings, and is to be held by the acceptance of this contract to approve of the method adopted for the execution of the works, and shall for the period of three months from the date of the completion of the work and the turning on of the current, be responsible for and make good at his own costs and charges all defects which may arise or be discovered in the work executed by him.

Maintenance.

Architect will Approve Course of Wiring. The architect is to approve the whole course of wiring cables, &c., that may show on the face of any portion of his interiors or exteriors, and where required such routes for wires, &c., are first to be shown by chalk lines for his inspection.

Notices. The contractor is to give all necessary notices to the Electric Lighting Company, and pay all fees legally demandable by them.

A complete set of plans showing the number and positions of all lamps, positions of switchboards, and also drawings showing the plans, elevations and sections of the buildings are on view at the architect's offices.

Wiring Rule of Company to be Observed. It must be distinctly understood that no discrepancy between the specification, general conditions, drawings and other particulars and the lighting company's wiring rules will be admitted as an excuse for the evasion by the contractor of such wiring rules, which must be entirely and implicitly complied with by the contractor.

Number of Lamps, Pressure, and Periodicity. The number of lamps will be 332, distributed as shown in the schedule attached. The pressure at the service lines will be 200 volts, the current alternating at a periodicity of 50.

Service Line. The service lines will enter the premises in the basement

immediately below the main entrance. Each service line will carry a maximum of 50 ampères.

Main Switch and Fuse.

Two separate main single pole switches and fuses mounted on separate blocks to be provided and fixed near the point where the service lines enter the premises in a position to be selected by the architect.

The main switchboard specially designed for the installation as described to distribute to   circuits of   ampères capacity each to the various parts of the building. The main switches shall be of massive construction, the base of enamelled slate not less than $1\frac{1}{4}$ in. in thickness, free from all impurities, planed and squared, and to have well rubbed faces and edges. The face and edges to be carefully enamelled black, and the slate shall be impregnated at the back with insulating compound. The conducting parts shall be of such a cross section that the current density when all lamps are on shall not exceed 500 ampères per square inch. The contacts shall be amply large, and so designed as to prevent heating. The break, which shall be at least $1\frac{1}{2}$ inches on each switch, must be a rapid one, and independent of the handle. No screws or conducting parts shall project at the back of the base, but should it be necessary to secure the fittings from the back the screw holes shall be deeply countersunk and filled up with some hard non-hygroscopic non-conducting composition.

The main fuse block shall be mounted in a similar manner to the main switch, and the general construction shall be the same.

The fuses shall be tinned copper, and shall consist of several small strands in parallel, easily replaced and arranged to break should the current exceed 50 per cent. above the normal full load.

Mounting of Main Switch and Main Fuse.

Both main switch and main fuse must be mounted upon hard wood, and enclosed in separate polished hardwood cases with glass covers, secured by means of good brass locks, three keys to be provided. The omnibus bars to which the main cable is to be connected, and from which the current will be distributed to the various circuits, must be of such a cross section that the current density shall not exceed 500 ampères per square inch when all the lamps are "on."

Cable to Distributing Board.

The cable from the main switch to the distributing board is to be heavily insulated with rubber, and to have an insulation resistance of 5,000 megohms per mile. At least two layers of heavy braiding over the insulating material must be provided. The current density when all lamps are "on" shall not exceed 500 ampères per square inch of cross section. This also applies to all the cables, wires and fittings on the premises.

The cable from the main switch to the distributing switch or fuse boards, and from these boards to lamps, switches and all other fittings, shall be carried (except in superintendent's dwellings) in welded wrought-iron pipes, the thickness of which shall be at least equal to ordinary iron gas barrel, and lined inside with some approved non-inflammable insulating material, and the pipes shall be in every case of ample dimensions to admit of the wires and cables they contain being readily withdrawn and replaced without injury to the insulation or protective covering. Not more than two pairs, *i.e.*, 4 wires are to be carried in any one pipe. All pipe work is to be perfectly free from roughness both inside and outside, and the ends of pipes are to be carefully rounded and free from sharp edges. Where concealed this pipe work is to be coated outside with a substantial covering of Dr. Angus Smith's compound carefully applied so as to completely cover the iron. The pipe work shall, however, generally run on the surfaces of the glazed bricks or other finished faces of the walls, in which case the exterior is to be free from the Angus Smith's compound, but is to be left suitable for subsequent painting by the contractor to tints decided upon by the architect. Where joints in pipes have to be made in the straight run on the surface of the glazed brickwork or other positions where they will be visible, couplings made to sample now in architect's office, but to be insulated inside, or to other equally approved design, will have to be used, and at such reasonably regulated intervals as the architect may determine. T's and angle pieces, where they are permissible, shall contain no sharp bends, but shall in all cases be carefully rounded and of approved design and construction for drawing wires through without risk of injury to the insulation or protective covering of the wires. T's and bends

Cable to Distributing Board. where visible are to be carefully finished and of neat appearance. The complete system of pipe work is to be water tight, and joints both between pipes and where pipes pass into junction boxes or wood blocks are to be screwed and run in with red lead, and effective means are to be taken to prevent condensation of moisture in any part of the service.

The method to be adopted for the prevention of condensation is to be fully explained by the contractor and approved by the architect before the work is commenced.

Fixing Pipe Work. Where these pipes show on the finished surfaces of the walls, whether of glazed bricks or otherwise, or on the ceiling, they are to be affixed thereto by plugging such wall or ceiling surface with hardwood plugs and screwing clips of an approved design into and entirely covering the same. The screws used in fixing these clips to be round-headed screws, one on each side of the pipe. These clips shall be fixed at such intervals that the pipe so fixed will be quite firm and rigid. Similar clips shall be used where the pipe is run on woodwork. The architect shall have a voice in the spacing and position of these clips for both structural and decorative reasons, and the contractor in mapping out upon the walls and ceilings the courses of all pipes, shall show similarly the position of each clip or coupling.

Where iron pipes are connected to the switch-boards, the end of each pipe so connected shall be neatly fitted into a separate hole drilled through the wood backing on which the switch-board is to be fixed.

Junction Boxes. Junction boxes of suitable dimension and of approved design shall be used in all cases where without them wires could not be readily drawn in and out of the system of pipes; bends in the pipes, therefore, unless they are very gradual, will only be allowed without the introduction of a junction box in exceptional cases where distances are very short and the wires small. It will not be necessary in most cases to provide a junction box where pipes are brought as specified into hardwood blocks supporting a ceiling rose, stiff pendant, or bracket fitting. In the case of straight runs for small leads junction boxes are to be provided at

Junction Boxes. intervals of never less than 50 feet. In those of larger leads or runs that are not straight they shall be placed at shorter intervals.

Instead of cable carried in iron pipes, the contractor may use, if preferred, cables run in wood casings, and joints made in boxes.

Junction boxes suitably designed without covers for holding a tumbler switch on a hardwood block shall be provided for all switches in the lecture theatre.

Junction boxes shall also be provided in every case where joints are necessary in cables or wires.

All junction boxes where visible shall be of an approved neat pattern or design harmonizing as much as possible with the other work.

Wood Blocks. All wood blocks for switches or fittings shall be of well-seasoned hardwood stop-knotted, primed and painted three coats and varnished to match the general painting of the several apartments, or to special tints of ordinary character that may be directed or required by the architect. Where pipes are carried on the surface they will be screwed into similar blocks left flush, with the finished surface of the wall or ceiling, the painted hardwood blocks being screwed to and covering these blocks. All blocks are to be cut away sufficiently as to enable the wires to be easily drawn in or out of position without straining the insulation.

Switches and Fuse Blocks on Distributing Board. The switches and fuse blocks to be provided on both poles are to be fixed on the distributing boards (to be fixed in the porter's office) to control the 10 circuits detailed below (which must have subsidiary distributing boards). They shall be of the same general construction as the main switch and fuse blocks, and the same precautions are to be taken as are described under that heading.

The switches and fuses must be plainly labelled with the particulars of the circuits which they severally control by means of endolithic ivory tablets or engraved metal.

All the switches and fuses on the positive sides shall be mounted on one board, and all those on the negative side on another board, each board being kept separate and having separate covers.

Particulars of Circuits. The circuits shall be arranged as follows :—

No. 1. Large lecture theatre.
,, 2. Small do.
,, 3. Museum.
,, 4. Laboratory.
,, 5. Workshops.
,, 6. Porter's apartments.
,, 7. Eastern class-rooms.
,, 8. Western do.
,, 9. Stores.
,, 10. Basement.

Meter Cabinet. Below the main distributing boards fix a polished hardwood cabinet. It shall be of the same wood as the case of the distributing boards, and in character with it, and shall be large enough to contain 3 meters and 3 maximum demand indicators, particulars of which will be supplied by the architect.

A cover of the same wood as the cabinet shall be hung upon brass hinges, and provided with a good brass lock and 3 keys. The cover shall be arranged to open downwards, and shall be polished.

Loops of Cables to be left in Meter Cabinet. Loops of cable shall be left in the meter cabinet for connecting to the meters.

Meter Connections. The meters will be connected as follows :—

No. 1. Meter half establishment.
,, 2. Meter half establishment.
,, 3. Meter private premises.

Conductors. All the conductors on the premises shall be of such a size that every lamp may, if necessary, be of 16-candle power, and those in the lecture theatre of 32-candle power each without exceeding the density of 500 ampères per square inch allowed. The lowest insulation resistance of conductors (except flexible cord) to be 600 megohms per mile.

Fall of Potential. The maximum fall of pressure allowed in any part of the premises shall be 1 per cent. when all the lamps are "on." No conductor of less than No. 18 S. W. G. shall be used, and all above No. 16 S. W. G. must be stranded. All conductors shall be composed of 98 per cent. pure copper,

Mathieson's standard for pure annealed copper, insulated with rubber and thoroughly tinned. All joints shall be carefully made and thoroughly sweated. Resin only to be used as flux.

Insulation of Joints. The insulation of joints shall be specially attended to, and no joint is to be covered up until passed by the architect.

Total Insulation Resistance. The total insulation resistance of the installation measured at the main switch shall be not less than one megohm with all lamps and fittings in position and all switches "on."

Flexible Cord. Each conductor of the smallest flexible cord used must be equal in cross section to No. 18 S. W. G., and shall be first covered with a layer of cotton or silk, over which shall be laid two layers of stout vulcanized rubber, then another layer of cotton or silk, which shall be covered with stout braiding. The insulation and covering shall be rendered impenetrable to loose ends which may be present in the conductor.

Protection of Wires, &c. The cables, wires, &c., where not enclosed in iron gas barrel pipe, shall be laid in strong casing of well seasoned wood, with a fillet dividing the two conductors of not less than half an inch in width, in case of the smallest size casing used, and increased in width in proportion for the larger sizes unless cables are run in varnished wood casings, with all joints made in boxes.

Covering to be Screwed Down. The cover of the larger casing shall be screwed down along the outer edges, and not to the centre fillet. All covering shall be fastened down with screws, and in no case with nails.

Chasing in Casing. Where casing is required to be used in the walls, it shall be so laid that the inside line of the cover of the casing is flush with the finished surface of the wall, and in such a manner that the cover may be removed without damaging the plaster.

Mitreing. All joints in both casing and cover shall be neatly and properly mitred.

Varnishing and Painting. All casing and cover shall be varnished inside with at least one coat of good thick shellac varnish. The outside shall be painted with two coats of good oil colour, the last to tint matching woodwork of room, or as architect may direct.

Cutting Away and Making Good. Wherever it is necessary to cut away plaster, woodwork, brickwork, or concrete form chases in the wall or ceilings, &c., all shall be done by this contractor, and all work disturbed by these operations made good by him entirely, in conformity with clause   of the Conditions hereto attached.

Gas Fittings and Sealing Off Pipes. Generally speaking, it is proposed to leave such gas fittings as may now be in the buildings for future use, but this contractor shall remove any of such as required, and cap off the pipes of these and others which may so require doing.

All gas, steam and water pipes, metal flues and metal work generally to be avoided as much as possible, and where it is necessary to fix conductors within six inches of any metal work, such special and extra precautions are to be taken as may be deemed necessary by the architect.

Single Pole Switches. The single pole switches shall be mounted on porcelain or enamelled slate. They shall be of the "quick-break" type, and so designed that they cannot remain in the intermediate between "on" and "off."

None of the screws on conducting parts shall pass through the back of the base. Sparking pieces to be provided to prevent injury to the contacts.

The screw connections shall be of a thoroughly reliable character, and not liable to work loose from the wire or base.

The switches shall be mounted on polished hardwood blocks. At least 1 in. break shall be allowed on all switches carrying more than two ampères. Every group of not more than 10—16 c.p. lamps, or their equivalent, shall be controlled by a separate switch.

Cut-Outs. Cut-outs shall be of the R. T. pattern, supplied by the General Electric Co., of 71, Queen Victoria Street, and shall be provided complete with fuses to couple the installation. (Sample on view.)

Fuses. Whenever a switch is provided for, a fuse shall also be provided in addition to the fuses in the ceiling roses.

For any current up to three ampères single pole fuses will be allowed, but above three ampères separate fuses shall be inserted in each wire.

All fuses shall be inserted in the circuit as near to the junction of the wires as possible, and in a conspicuous position.

The fuses shall be of the same general construction as the switches, and must be mounted on polished hardwood blocks.

Ceiling Roses. The general description of the switches and fuses applies also to the ceiling roses. Cord grips, or some other suitable and approved device, shall also be provided, in order to prevent strain being put upon the contacts.

All ceiling roses shall be mounted on polished hardwood blocks.

Lamp Holders. Lamp holders shall be of the improved Edison Acorn type. When these holders are used for flexible pendants they shall be provided with ebonite nipples, so designed that the wires are not likely to become detached or to work loose.

All holders shall be provided with cord grips and suitable shade carriers.

Fitting Switches. The fitting switches shall be of some approved pattern.

The controlling switches shall be placed in the most convenient positions for controlling lights on entering or leaving the various rooms, and their position shall be approved by the architect.

Shades. Pendant lights and all fittings shall be supplied with conical opal shades, except for some few of the electroliers, in which cases suitable tulip-shaped shades of a colour and design approved by the architect shall be substituted.

Glow Lamps. Glow lamps of the Edison Co.'s English make, $3\frac{1}{2}$ watt per candle grade, are to be supplied to all the lighting points shown upon the plans.

Fittings. The design of the various electroliers, pendants, brackets, standards, &c., is shown on a sheet of drawing on view at the architect's office. Their positions are shown on the plans, and the schedule of lamps and fittings appended hereto. The fittings supplied are to be of the dimensions shown on the drawings, and in the case of those fittings where patterns are on view such patterns shall be strictly adhered to for design.

All fittings as fixed shall be well insulated from earth. The insides of the tubes of fittings through which wires pass shall be quite smooth and free from ragged edges, and be left perfectly clean. No joints in wires will be allowed in fittings except where carefully constructed junction

Fittings. boxes of ample dimensions form part of the design of the fitting. The nipples to receive lamp holders shall in all cases be $\frac{5}{16}$ in. long, with $\frac{1}{2}$ in. standard brass thread. The tubes used for those fittings marked "wrought iron" on the drawings shall be carefully welded, and the nipples to receive lamp holders shall be of malleable iron. The short pendant marked A may be made of malleable iron.

All wrought iron and malleable iron fittings shall be carefully painted with three coats of oil colour, finishing to a tint in each case to be determined by the architect.

[Here should follow the schedule of lamps and fittings.]

ROADS AND PATHS.—*See Notes, p. 568.*

Garden Paths. The garden paths shall be 6 ft. and 9 ft. in width respectively.

Dig to a sufficient depth to receive the gravel and other material, form the surface to a contour, which shall give $\frac{3}{4}$ in. fall to each foot from the centre to the sides, and the lowest part to fall towards the gulleys.

Lay all over the bed gravel stones broken to pass a 2 in. ring, and 3 in. thick, and cover with 3 in. of bright, sharp gravel. Thoroughly water and well roll each layer.

Supply and bed in cement concrete at every 30 ft. in the length of path, but on alternate sides of the path, a Broad's Fig. 116 gulley, 9 in. diameter, 4 in. outlet, and connect with drain.

Lay along one side of all paths a 4 in. stoneware drain, jointed in cement, and the joints puddled around with clay, the drains to discharge into the ditch on the south-western boundary of the gardens. Fix over each end, discharging into the ditch, a 9 in. by 9 in. Broad's school board locking gulley grating, with 9 in. by 3 in. tooled York lintel, and sill each 14 in. long, the lugs of the grating let into both, and run with lead.

A Farm Road. Form the road as shown by section Fig. 62, 22 ft. wide, 12 ft. of the width in the centre, to be excavated 12 in. in depth to receive the ballast and gravel. Level the bed, and roll with a 2 ton horse roller; cover the whole surface of the road bed with hard burnt

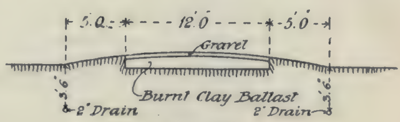


FIG. 62.

ballast, 8 in. deep at the sides, and 12 in. in the centre. Lay over the burnt ballast clean, sharp, rough gravel, 4 in. thick, and roll as before; any stone more than 2 in. either way shall be broken.

Lay on each side of the road, about 3 ft. in depth, a drain of 2 in. agricultural drain pipes, falling towards and discharging into the nearest ditches or the brook.

There shall be no carting over the road bed after it is formed; the ballasting shall be commenced from one or both ends, and carting continued over it.

A Country Road through New Land.

The line of the proposed road will be indicated by a line of stakes driven along its centre. Grub up and clear away any trees, bushes, stumps, or roots for a space of 20 ft. on each side of the centre line.

Excavate for and form the road bed to the contour shown on drawing (Fig. 63) for an entire width of 30 ft. Excavate the central part for a width of 16 ft. to receive the metalling; level the bed and roll it.

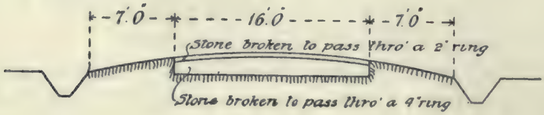


FIG. 63.

Dig for limestone in the parish quarry (contractor may have the stone free of charge), break the stone into pieces about 4 in. either way, cart and shoot it on the road bed to form a layer 12 in. deep at the sides; thoroughly water and roll with a 2-ton roller.

Cover the bed last mentioned with a layer of 6 in. uniform thickness of field flints, broken to pass a $1\frac{1}{2}$ in. ring; thoroughly roll as before.

There shall be no carting over the road bed after it is formed; the ballasting may be begun from one or both ends, and carting continued over it.

The earth and rubbish from the road formation shall be carted away, and disposed of by the contractor.

Dig the ditches on each side of the road as shown on the drawing, and deposit the earth to form a bank on the field side.

After rolling the layer of flints, sharp, coarse, screened gravel shall be laid 1 in. deep all over the surface, watered and again rolled. The duration of the period of rolling shall in all cases be at the discretion of the architect.

Dig and form the bed of the roadway (Fig. 64) to the contour shown on the drawing, and cart away the earth.

A Macadamized Town Road with Footways.

Thoroughly roll the road bed, lay thereon 12 in. thick of broken brick or stone in fragments 4 in. each way, and free from rubbish; put on in two layers. Cover this with a 6 in. layer of approved Guernsey granite, broken to pass a 2 in. ring put on in two thicknesses of 3 in. Each layer shall be rolled. Finish with clean Thames sand, 2 in. thick, watered and rolled.

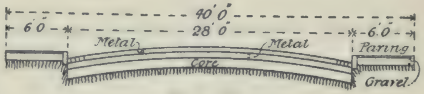


FIG. 64.

Each layer to be watered and rolled with a 15-ton steam roller to the extent which the architect shall deem sufficient.

Pave the gutters with 6 in. by 3 in. Guernsey granite setts, laid to fall on Thames ballast 6 in. thick, and grouted with cement grout.

Supply at the distances shown on plan Waller's (16, Queen Victoria Street, London) iron-trapped gulley boxes for 10 in. gulleys, surrounded and bedded in cement concrete 12 in. beyond the box each way. Connect by 6 in. stoneware pipe with the sewer; cover with Waller's No. 72 hinged gulley grate and frames, and carefully fit the granite pitching around.

Pave the footways with the best quality 3 in. Silex branded York stone paving, in stones not less than 8 ft. superficial, laid to slight fall towards the curb, every joint tooled the whole depth of the stone bedded and jointed in blue lias mortar on 6 in. of clean, rough Thames ballast well rammed.

The curbs shall be 12 in. by 6 in. Aberdeen granite, in not less than 3 ft. lengths, fixed on edge, hammer dressed where exposed, drafted 1 in. wide along the top edges and at the top of the back edge, and bedded and jointed in cement mortar.

The corners of the curbs at junctions with the side roads shall be out of the solid, and of the radius shown on the plan.

Road Paved with Granite Setts.

Dig and form the bed of the roadway to the contour shown on the drawing and cart away the earth. Lay thereon Portland cement concrete 9 in. thick composed of five parts clean ballast, one of sharp sand, and one of cement, laid in two thicknesses and well beaten. Float 1 in. thick

with equal parts of cement and sand. Finish with Mountsorrel granite setts 9 in. by 4 in. and 8 in. long, laid in sharp sand in regular courses, breaking joint and rammed, and with close joints, and fill the joints with fine shingle. Grout with cement and sand, cover the whole surface at completion with half an inch of sharp clean gravel, no pebbles therein to exceed $\frac{3}{4}$ in. by $\frac{3}{4}$ in.

Form the channels with four courses of similar setts but 12 in. long, laid lengthwise.

Road Paved with Asphalte. Dig and form the bed of the roadway to the contour shown on the drawing, and cart away the earth. Lay over the whole surface of the road bed Portland cement concrete 9 in. thick composed of five parts of clean ballast, one of sharp sand, and one of cement, laid in two thicknesses and well beaten, float 1 in. thick with equal parts of cement and sand. Finish with Limmer compressed asphalte to be 2 in. thick when completed and laid by the company's own men. Cover after laying with $\frac{3}{4}$ in. of sharp dry sand.

The asphalte shall not be laid until the architect certifies that the concrete is dry and gives permission to lay it.

Road Paved with Wood Blocks. Dig and form the bed of the roadway to the contour shown on the drawing, and cart away the earth. Lay over the whole surface of the road bed Portland cement concrete 9 in. thick, composed of five parts of clean ballast, one of sharp sand, and one of cement laid in two thicknesses, and each layer well beaten. Float 1 in. thick with equal parts of cement and sand. Finish with sawn blocks of Jarrah 9 in. by 3 in. and 5 in. deep laid end grain, the wood to be of the best quality and free from all defects. The blocks shall be laid in regular courses breaking joint and rammed. Keep the joints $\frac{3}{8}$ in. apart by wooden laths afterwards withdrawn. Run with a mixture of three of pitch to one of creosote oil boiled together and with which the joints shall be filled. Finally cover the surface $\frac{1}{2}$ in. thick with clean gravel, no stone more than $\frac{3}{4}$ in. by $\frac{3}{4}$ in.

Form the channels with six courses of similar blocks laid lengthwise.

Tar Paved Footway. Level and ram the ground for footways, and lay a bed of limestone 6 in. thick broken to pass a 2 in. ring, and thoroughly roll with a heavy roller. Lay thereon tar paving 3 in. thick of Kentish ragstone broken to pass $1\frac{1}{4}$ in.

ring, and boiled until thoroughly saturated with a mixture of $2\frac{1}{2}$ parts pitch to $1\frac{1}{2}$ parts Stockholm tar, and well rolled. Dress after rolling with a thin coat of clean sharp sand.

Gravelled Footways. Dig of sufficient depth and cart away the surplus and roll, lay a bed of 6 in. of hard dry brick or stone fragments free of rubbish, level and roll. Lay thereover 3 in. of clean ballast, and well roll. Finish with 3 in. of clean sharp gravel, water and roll.

Extraordinary Traffic. When buildings are very large, the wear of the roads in the vicinity is much increased, and a claim for their repair is likely to be made by the local authority—a condition should be inserted.

"The contractor shall pay any legitimate claim made by the local authority for extra wear to, or damage of the roads, consequent upon the traffic to or from these works."

SECTION VI:

SEPARATE CONTRACTS.

STRUCTURAL IRONWORK.—*See Notes, p.* 479.

SPECIFICATION FOR SUPPLY AND FIXING OF STRUCTURAL IRONWORK TO A WAREHOUSE IN KNIGHTRIDER STREET, LONDON, FOR JAMES THOMPSON, ESQ.

HENRY JAMES,
Architect,
Wood Street, London.

January, 1899.

Quality. The whole of the ironwork and steelwork to be of English manufacture, and the whole of the materials and workmanship to be the best of their respective kinds.

Inspection. The architect or his representative, or any person he may employ to inspect the work on his behalf, shall have power and facilities to attend the works of the makers of the ironwork, and to inspect the work in progress or before delivery, and at any time either before or after delivery, to reject such work or parts of it as appear to him not to comply with the terms of the specification.

Breaking up of Castings. The architect shall have the right to insist upon the breaking up at once of any casting which may appear to him to be defective.

Selection and Testing. The architect or his representative shall have the right to select samples of the ironwork, and to have any portion tested at the manufacturer's expense.

Cutting away and making good Scaffolding. The iron and steel work to be delivered and fixed on the building by the manufacturer, who shall do his own cutting away and making good. The general contractor will afford the manufacturer the use of his ordinary scaffolding and ladders as erected for the construction of the building, but the manufacturer must make his own arrangements for any plant and scaffolding beyond these.

Setting Out. The manufacturer shall set out the work and be responsible for and make good and amend at his own expense any errors which may arise therein.

Weighing Machine. The contractor shall supply and set up on the premises a weighing machine to weigh up to 2 tons, shall shift it from time to time as may be required, and remove it at completion of works. All the work required for the basement storey, including the floor of ground floor, shall be delivered and fixed before for ground storey, including the floor of second storey, before second storey, including floor of third storey, before third storey, including roof, before

Penalty. If the manufacturer shall fail to deliver the iron or steel work at the stipulated rate he shall pay or allow to the building owner as and by way of liquidated and agreed damages, the sum of £ per week for every week during which the building shall be delayed in consequence thereof. (As a rule this sum should equal the rate of the liquidated damages on the general contract.)

Reinstate Defective Work. Any part of the work which shall prove defective between the date of its delivery and the end of six months after the completion of the building, shall be removed and reinstated at the manufacturer's expense.

(The above-mentioned period for maintenance should be the same as for the general contract.)

Payments. When the value of the works executed and not included in any former certificate shall from time to time amount to the sum of £ or otherwise at the architect's reasonable discretion, the manufacturer shall be entitled to receive payment at the rate of 80 per cent. upon such value until the difference between the percentage and the value of the works executed shall amount to 10 per cent. upon the amount of contract, after which time the manufacturer shall be entitled to receive payment of the full value of the works executed and not included in any former payment, one moiety of the balance to be paid on completion and the remainder months afterwards. (Insert period of maintenance.)

Deposit Priced Copy of Estimate. Any alteration in the work is not to vitiate the contract, but is to be valued in accordance with the original estimate, and for this purpose a fully priced copy of the estimate is to be deposited with the architect.

Cast-Iron. The dimensions on the drawings are believed to be correct, but the contractor to be responsible for their accuracy, and to examine them before putting the work in hand. Supply all patterns, and, if requested by the architect, submit them for approval before casting.

Quality of Castings. The stanchions, base plates, columns, and other castings shall be clean, sound, smooth, free from flaws, holes, cinders, air blows and all other imperfections, the whole, particularly the base plates, to be slowly and carefully cooled, to avoid internal strains in the metal, and to be perfectly true. No lead or other plugging will be allowed.

The metal for castings shall be of such quality that test bars cast from the same meltings shall bear the following tests:—

Test Bars. Test bars, 3 ft. 6 in. long 2 ft. deep by 1 in. thick, when placed on bearings 3 ft. apart shall bear 27 cwts. in the centre without breaking, and with that weight suspended in the centre shall deflect not more than $\frac{9}{32}$nds. of an inch.

Test bars shall be taken from as many of the meltings as the architect may consider necessary.

Planing Surfaces. The top bearing surfaces of all base plates and the junction flanges of all stanchions and columns shall be planed.

Holes and Bosses. All holes for bolts shall have a slightly raised boss cast on. Uniformity of thickness of metal of all castings shall be observed as much as possible.

Wedging and Running Bases. The bases of all stanchions and columns shall be wedged up 1 in. from the stone base with iron wedges and run with pure Portland cement 1 in. thick.

Wrought Iron. The iron to be of the best quality, tough, fibrous and even, and of uniform grain. Angles and tees equal to a strain of 21 tons per square inch of sectional area and a minimum reduction of area of 12 per cent. Rod iron and bolts to be equal to a strain of 23 tons per square inch and a reduction of 13 per cent.

Sizes of Angles, Tees, &c. The sizes of all wrought-iron angles, tees, channels, &c., which are specified, are taken from stock lists, and should be such as are obtainable in the market, if not, the nearest suitable size may be used subject to the approval of the architect.

Bolst. All bolts to be of the sizes indicated on the drawings and made from one piece of metal, those of $\frac{5}{8}$ in. diameter and

upwards to have hexagonal heads and nuts of proper proportion, the shanks and screwed ends of the bolts in every case to project not less than $\frac{1}{8}$ in. beyond the face of the nut.

Steel. The steel used shall be mild steel, manufactured by the Siemens-Martin open hearth acid process, the rolled $1\frac{1}{2}$ in. sections shall be free from scales, blisters, laminations, cracked edges and defects of every sort.

Tests. The sample cut from the steel rolled joists shall sustain a tensile stress of not less than 28 tons per square inch of original section, and shall show an elongation of 20 per cent. in a length of 10 in., the contraction of sectional area or fracture being not less than 40 per cent.

The steel for the rivets shall not contain more than $\frac{2}{10}$ths per cent. of carbon. The tensile strength shall not exceed the limit of 25 to 27 tons per square inch of section with an elongation of 50 per cent. in a length of 2 in.

Holes to be Drilled. All holes for rivets and bolts in steel girders and rolled joists shall be drilled and not punched. **Riveting.** The riveting shall be executed in the best manner. All holes shall be perfectly fair and true, and shall exactly coincide with each other. The rivets shall fill the holes tightly and completely with sound and well-formed heads and snaps of uniform size.

Defective Rivets. Any rivets loose or defective or with burnt or cracked heads shall be cut out and replaced by new and perfect ones.

Bearing of Girders and Joists on Iron. Where the cast-iron lugs or stanchions are bolted to the ends of rolled girders or joists take care that the bearings of such girders or joists depend upon the head plate of the stanchion and not on the bolt.

Holes in Flanges of Joists shall be near their Ends. Avoid as far as possible holes and bolting in the flanges of joists and girders except at or near their ends.

Connectors of Angle Steel. All angles used for connections shall be as long as the web of the beam and wide enough on the web to contain as many bolts or rivets to resist shearing and bending strains as shall equal one-half of the safe strength of the framed beam.

Remove Scale. Thoroughly remove all scale to the bare metal and oil while hot with boiled linseed oil.

Inspection and Passing of the Work. The work will be inspected and approved in its oiled state, and no further coating shall be applied until the architect or his representative has passed the work.

Painting. After the approval the whole of the work shall receive one thin coat of oxide of iron paint before delivery, and a second coat upon all exposed parts after fixing.

Distance Pieces. Girders formed of two or more beams shall have between the webs, not more than 5 ft. apart, cast-iron distance pieces and $\frac{3}{4}$ in. bolts, two for girders 12 in. deep and over, and one for 10 in. beams and under.

Bearing of Girders and Joists on Walls. The bearing of joists on walls generally shall be 6 in. at each end, those to spans of 20 ft. and over shall be 12 in. at each end.

MANUFACTURE AND DELIVERY ONLY OF TERRA-COTTA.—*See Notes, p.* 524.

SPECIFICATION FOR MANUFACTURE AND DELIVERY OF TERRA-COTTA AT THE NEW PUBLIC LIBRARY, COCKERMOUTH.

GEORGE SMITH,
Architect,
Russell Square,
November, 1899. London.

Quality. The whole of the terra-cotta to be thoroughly burned, of uniform colour, free from cracks or other defects, the arrises sharp and true, the enriched work clean and sharp, and the **Jointing.** whole equal in finish to the original models all jointed in accordance with the detail drawings, and chambered as required, but so as in no place to leave a less thickness than 2 in.; none of the surfaces shall be coloured by an applied wash. The mortises, joggles, grooves, perforations, &c., to be prepared on each piece before the burning, and each piece to be so prepared as to require no filing, rubbing, or chipping after the firing; the whole to be **Colour.** equal in colour, truth of line, and finish to samples, which are to be deposited with the architect before signing contract. All joints shall have chipping pieces and recesses or projections for joggling together.

Samples. The samples deposited by the manufacturer shall exhibit the extreme variation which will be allowed, from a straight line in the moulded work and arrises, the style and finish of the decoration, and the colour of the finished work from differences in burning. The manufacturer shall, on the rejection of any piece, forthwith supply an additional piece, and no additional time will be allowed for the completion of the contract because of this substitution.

Piece Moulds. Careful piece moulds of the blocks shall be made by the

Piece Moulds. manufacturer for the purpose of moulding without blocking or stopping up the several parts with clay.

Delivery. The terra-cotta is to be delivered on the site at the manufacturer's expense, and to be unpacked by the contractor; but the manufacturer shall be responsible for any damage that may occur to it before the unpacking.

Setting Out. The terra-cotta shall thoroughly bond and course with the brickwork.

The manufacturer shall set out the work with the contractor's assistance, and they shall together arrange as shall be necessary for the identification of the pieces of terra-cotta; but the manufacturer shall be responsible for the allowance for shrinkage, and for the accuracy of the size of each finished piece, and shall prepare his own shrinkage details, and shall mark each piece as arranged with the contractor.

Injury. Should any piece of terra-cotta be injured during the progress of the building from defects in the manufacture, it will be at the option of the architect either to have such piece replaced by the manufacturer or by the general contractor at the manufacturer's expense, or to deduct the full cost of such replacement from the amount due under the contract.

Inspection of Work. The architect, the clerk of works, and the builder engaged upon the building shall at all times have access to the manufactory to examine the work being prepared, and the manufacturer shall give all reasonable facilities for such purpose so long as they do not impede the work.

Models. The models for the enriched work will be prepared for the manufacturer's use, but he shall perform all packing and carriage of them from the building to his works. The remainder of the models to be made by the manufacturer.

Or,

The manufacturer is to make and supply all the models that may be required, and in conjunction with the builder and clerk of works is to set out the whole of the terra-cotta, to take all responsibility as regards the number of each piece, of the order of delivery, the setting out of the work

to the scale of shrinkage required, and of the production of the goods of the correct size for use in the building.

Rate of Delivery. The whole of the terra-cotta shall be delivered between the day of and the day of , and the rate of delivery shall be in a regular proportion to the quantity and the time, commencing on the first-mentioned day.

Penalty. If the manufacturer shall fail to deliver the terra-cotta at the stipulated rate, he shall pay or allow to the employers, as and by way of liquidated or agreed damages, the sum of £ per week for every week during which the building shall be delayed in consequence thereof. (As a rule, this sum should equal the rate of liquidated damages on general contract.)

Maintenance. Any part of the work which shall prove defective between the date of its delivery and the end of six months after the completion of the building shall be removed and reinstated at the manufacturer's expense. (The above-mentioned period for maintenance should be same as for general contract.)

Payment. When the value of the works executed, and not included in any former certificates, shall from time to time amount to the sum of £ , or otherwise, at the architect's reasonable discretion, the manufacturer is to be entitled to receive payment at the rate of 80 per cent. upon such value until the difference between the percentage and the value of the works executed shall amount to 10 per cent. upon the amount of contract, after which time the manufacturer to be entitled to receive payment of the full value of the works executed, and not included in any former payment, one moiety of the balance being paid on completion, and the remainder in months. (Insert period of maintenance.)

Variations not to Vitiate Contract. Any alteration in the works is not to vitiate the contract, but is to be valued in accordance with the original estimate, and for this purpose a fully priced copy of the quantities is to be deposited with the architect.

A Sum Provided for Models. The models for the enriched work will be supplied by Messrs. , and for these a sum is provided in general contract.

MANUFACTURE, DELIVERY, AND FIXING OF FAÏENCE.—*See Notes, p.* 423.

SPECIFICATION FOR THE MANUFACTURE, DELIVERY, AND FIXING OF FAÏENCE AT THE PROPOSED CONSERVATIVE CLUB HOUSE FOR THE BUILDING COMMITTEE.

GEORGE SMITH,
Architect,
Russell Square,
London.

November, 1899.

Work which Building Contractor shall do.

The general contractor shall prepare all the cement floated faces, shall supply the necessary water, shall supply assistance in setting out and sheds for the deposit of the material, shall case and protect it from injury before and after its fixing, shall supply and erect scaffolding and afford use of ladders, and remove them at completion, and shall cut away and make good any structural work.

Defective Pieces shall be Replaced by Perfect Pieces.

The faïence shall be delivered on the site free from damage, and any piece of it which is disapproved by the architect shall be forthwith removed and a perfect piece supplied.

Setting Out.

The manufacturer shall set out the work with the contractor's assistance, and he shall be responsible for the allowance for shrinkage and for the accuracy of the size of each finished piece.

Models.

The models for the enriched work of special design will be prepared for the manufacturer's use, but he shall perform all packing and carriage of them from the building to his works, the remainder of the models to be made by the manufacturer.

Rate of Delivery.

The whole of the faïence shall be delivered between the day of and the day of , and the rate of delivery shall be in a regular proportion to the quantity and the time commencing on the first-mentioned day.

Penalty. If the manufacturer shall fail to deliver the faïence at the stipulated rate he shall pay or allow to the building owner as and by way of stipulated or agreed damages, the sum of £ per week for every week during which the building shall be delayed in consequence thereof.

As a rule this sum should equal the rate of liquidated damages on the general contract.

Maintenance. Any part of the work which shall prove defective between the date of its delivery and the end of months after the completion of the building shall be removed and reinstated at the manufacturer's expense.

(Note the period for maintenance should be the same as for the general contract.)

Payment. When the value of the works executed and not included in any former certificates shall from time to time amount to the sum of £ , or otherwise at the architect's reasonable discretion, the manufacturer is to be entitled to receive payment at the rate of 80 per cent. upon such value until the difference between the percentage and the value of the works executed shall amount to 10 per cent. upon the amount of the contract, after which time the manufacturer shall be entitled to receive payment of the full value of the works executed, and not included in any former payment. One moiety of the balance shall be paid on completion and the remainder months afterwards. (Note.—Insert period of maintenance.)

Variations shall not Vitiate the Contract. Any alteration in the work shall not vitiate the contract, but shall be valued in accordance with the original estimate, and for this purpose a fully-priced copy of the quantities (or original estimate) shall be deposited with the architect within a week of the signing of the contract.

Quality. The whole of the faïence shall be thoroughly burned, of uniform colour, and lustre of glaze, free from cracks or other defects, the arrises sharp and true. The enriched work to be clean and sharp, and that for which the models are supplied shall be equal in finish to the original models. The whole shall be jointed in accordance with the detail

drawings and chambered as required, but in no place to have a less thickness than 2 in.

Mortises, &c., to be Prepared before the Firing. The mortises, joggles, grooves, perforations, &c., shall be prepared on each piece before the burning, and each piece to be so prepared as to require no filing, rubbing, or chipping after the firing.

Work to be Equal to Samples. The whole to be equal in colour, truth of line, and finish to samples, which are to be deposited with the architect before signing the contract.

Bonding. **Joints.** **Filling.** **Pointing.** The structural pieces of faïence shall be thoroughly bonded with and course with the brickwork, and no joint shall exceed $\frac{1}{8}$ in. in thickness. The pieces which are chambered shall be soaked with water and filled in with concrete, composed of one part by measure of Portland cement, two of sand, and four of clean ballast, the stones to pass an inch ring. The whole to be set and pointed in coloured Parian cement, cleaned down at completion and left perfect.

Arrises shall be True. All the vertical and horizontal arrises to be left exactly true and regular.

QUARRY WORKED STONE.—*See Notes, p. 429.*

SPECIFICATION FOR WORKING AND DELIVERY OF QUARRY WORKED STONE TO BE SUPPLIED FOR PROPOSED CHURCH OF ST. MARY AT ——— FOR THE BUILDING COMMITTEE.

GEORGE SMITH,
Architect,
Russell Square,
November, 1898. London.

Kind. The stone to be Monk's Park Bath stone, quarry worked and all finished with a finely dragged face.

Quality. The stone shall be of the best quality, free from vents, beds, sand, or clay holes, threads, flaws, and all other imperfections worked, so as to set on its natural bed unless specially excepted and strictly to detail.

Beds. The beds of the stones are marked on the detail drawings. They are the dimensions of the stone as they come to the banker.

Quality to be Equal to Sample. **Stone shall be Fitted ready for Setting.** **Stones shall be Numbered.** **Rate of Delivery.** The quality of the stone shall be equal to a sample deposited with the architect. The stones shall be fitted together ready for setting, and shall include all necessary joggles and holes for dowels. The stones shall be marked with numbers for identification, shall be accompanied by a key plan, and shall be delivered at convenient times. All the stone required below and up to level of ground floor before . All the stone required between ground and first floor before . The remainder before .

Replace Damaged Stones. The quarry owner shall replace any stone damaged in transit with a new and similar stone without extra charge.

Delivery. The stone is to be delivered on the site at the quarry owners' expense, and shall be unpacked and unloaded by the general contractor.

Setting Out. The quarry owner shall set out the work with the general contractor's assistance, and they shall together arrange as may be necessary for the identification of the stones.

Responsibility for Size of Stones. The quarry owner shall be responsible for the size of each finished piece, and shall mark each piece as arranged with the contractor.

Penalty. If the quarry owner shall fail to deliver the stone at the stipulated rate he shall pay or allow to the building owner as and by way of liquidated and agreed damages the sum of £ per week for every week during which the building shall be delayed in consequence thereof (as a rule this sum should equal the rate of the liquidated damages on the general contract).

Maintenance. Any part of the work which shall prove defective between the date of its delivery and the end of six months after the completion of the building shall be removed and reinstated at the manufacturer's expense. (The above-mentioned period for maintenance should be the same as for the general contract.)

Payment. When the value of the works executed and not included in any former certificate shall from time to time amount to the sum of £ , or otherwise at the architect's reasonable discretion the quarry owner shall be entitled to receive payment at the rate of 80 per cent. upon such value until the difference between the percentage and the value of the works executed shall amount to 10 per cent. upon the amount of contract, after which time the quarry owner shall be entitled to receive payment of the full value of the works executed and not included in any former payment. One moiety of the balance to be paid on completion and the remainder months afterwards. (Insert period of maintenance.)

Variations not to Vitiate the Contract. Any alteration in the work is not to vitiate the contract but is to be valued in accordance with the original estimate, and for this purpose a fully-priced copy of the estimate is to be deposited with the architect.

SECTION VII:

SCHEDULES OF PRICES, TENDERS, ETC.

SCHEDULES OF PRICES.

Variety of Schedules.—As a schedule of prices bears some resemblance to a specification it may be briefly referred to here. There are three common forms of them:—

1. A schedule for price per hour of labour, to be used for day accounts on a "lump sum" contract.

2. A schedule of prices of labour and material for a work done entirely by day work, the expenditure of time and material being watched by the clerk of works.

3. A schedule of prices which combines 1 and 2, *i.e.*, prices for measured work complete, usually measured by the quantity surveyor, prices for time per hour and materials per bushel, yard, foot cube, &c., for work which can only justly be charged as day work.

When Schedules of Prices may be Used.—It is obvious that works of intricate shoring, underpinning, or restoration, can often be best dealt with by day work, *i.e.*, accounts periodically returned of material and labour actually used. This is Form 2.

In other cases it is important to commence a work before the specifications or drawings are ready. This may be Form 3.

In the cases 1 and 2 the schedule commences with conditions of contract and description of materials, and finishes with a form of contract, which is signed by both parties thereto.

The construction of schedules of prices is described in detail in Leaning's "Quantity Surveying."

INVITATION TO TENDER.

Use of Form of Tender Expedient.—A form of tender is convenient and expedient for several reasons. It ensures an offer in the form and terms desired. If in proper form its acceptance by the building owner makes it a binding contract. See *Lewis* v. *Brass.* This fact is well-known to most contractors, and not unfrequently the contractor substitutes for the form supplied to him another, in which he embodies the essential parts, but substitutes for the phrase, "I am willing to contract for," the words "I estimate the value."

To provide against this possibility some architects insert the words:—

"Any alteration in this form of tender will prevent its being taken into consideration."

Separation of Items of a Tender.—The separation of items in a form of tender enables the architect to readily omit any section of the work of the building of which he may have been in doubt.

Statement in Tender of Amount of Credit.—The statement in the form of tender of the amount of credit for old materials is favoured by some as producing a better price.

Alternative Prices in a Tender.—The cost of alternative prices for varied material for certain works is best put into a uniform shape by a form of tender.

Statement in Tender of Time of Completion.—When the early completion of a building is desired, it is sometimes made a subject of competition by a clause in the tender.

Invitation to Tender.

Various Methods of Invitation to Tender.—This may be given in two ways, by public advertisement or by invitation of a given number of builders without advertisement. After advertisement either the whole of the applicants may be allowed to tender, or a selection may be made from them. The latter is the more

frequent course, as the delivery of a reasonable tender is just as probable from a comparatively small number of men as a large one, and it is unfair to give a great number of builders the trouble of estimating. The alternative is to invite by letters a number of builders of equal reputation for good work, and the letter may be in a similar form to an advertisement. In either case the statement should be made whether or not quantities are to be supplied.

Forms of Advertisement for Tenders.—The advertisement may take some such form as follows :—

"Persons willing to tender for the erection of a house and offices at Godalming may see the drawings and specification at the office of the architect, William Brown, 2, Fenchurch Chambers, E.C., on and after May 6th, 1899. Quantities will be supplied. The tenders to be delivered at the office of the architect at or before 1 p.m. on Saturday, May 20th, 1899. Each contractor to deliver with his tender a copy of his estimate fully priced and moneyed out. The building owner does not bind himself to accept the lowest or any tender."

Or,

"Persons willing to tender for the erection of a house and offices at Godalming may send their names to the architect, William Brown, 2, Fenchurch Chambers, E.C., before May 6th, 1899. Quantities will be supplied. The building owner does not bind himself to accept the lowest or any tender."

Inspection of Documents before Tender.—At the architect's office there should be ready for the contractor's inspection a copy of the drawings, specification, conditions, and contract.

FORM OF TENDER.

TENDER FOR THE ERECTION OF HOUSE AND OFFICES AT GODALMING FOR JOHN SMITH, ESQ.

To WILLIAM BROWN, Esq.,
Architect,
2, Fenchurch Chambers, E.C.

SIR,—I am willing to contract for and perform the whole of the works required to be done in the erection of a house and offices at Godalming, Surrey, for John Smith, Esq., according to the drawings and specifications and general conditions prepared by you for that purpose, and to your entire satisfaction for the sum of pounds.

When several items require statement, the above would be varied by the substitution of the words:

"For the undermentioned sums:—

For the house as bill No. 1 £ .
For the conservatory as bill No. 2 £ .
For the stable as bill No. 3 £ .

or the whole for the sum of £ ."

When alternatives are contemplated:—

"If the joinery be executed in deal, as per alternative estimate bill No. 17, I am willing to reduce the last-mentioned amount by the sum of pounds.

"And I am also willing to allow a deduction of pounds for the old materials as per bill No. , credits, and I am also willing to execute any day works at the prices for labour in the schedule attached hereto."

And I am willing to complete the buildings within three months of the date of signing the contract, instead of the time prescribed by the conditions of contract, in consideration of an addition of per cent. to the foregoing amount.

And I also agree to sign the contract, when called upon to do so, within a month from the date hereof.

As witness my hand this day of , 1899.

Signature .
Address .

SCHEDULE FOR LABOUR PRICES IN DAY ACCOUNTS.

	Per Hour.		Per Hour.
Excavator		Plumber, labourer	
Bricklayer		Plasterer	
Do. labourer		Do. labourer	
Mason		Do. boy	
Do. labourer		Smith	
Slater or Tiler		Do. labourer	
Do. labourer		Gasfitter and Bellhanger	
Slate Mason		Do. labourer	
Do. labourer		Glazier	
Carpenter		Painter	
Do. labourer		Do. labourer	
Joiner			Per Day.
Do. labourer		Horse, cart and man	
Plumber		Two horses, cart and man	
Do. mate			

The above prices and prices for day work generally to include use of scaffold and all tackle tools, tool sharpening, water and general foreman's time. Subordinate foremen to be charged as ordinary workmen. Time for fixing and removing scaffolds will be allowed.

FORM OF CONTRACT.—*See Notes, p.* 572.

Contract entered into this twelfth day of June, one thousand nine hundred, between John Burke, builder, of North Road, Surbiton, Surrey, builder, hereinafter called the contractor, of the one part, and George Gordon, of London Road, Leatherhead, in the County of Surrey, hereinafter called the employer, of the other part as follows:—

1. In consideration of the sum of four thousand three hundred and twenty-five pounds to be paid to him as hereinafter mentioned, the contractor agrees with the employer, his executors, and administrators to build and complete, by or before the first day of July, one thousand nine hundred and one, a house with conservatory, stables, boundary walls, and appurtenances in London Road, Leatherhead, Surrey, as particularised by the accompanying specification and drawings signed by the contractor under the superintendence, and to the satisfaction of George Smith, Russell Square, London, architect, or in case of his death of such other architect as the employer shall, by writing under his hand, appoint, and under and subject to the general conditions annexed to the specification, and also signed by the contractor.

2. And the employer agrees that, subject to and on performance by the contractor of this contract, the contractor shall receive and be paid, by himself or his executors or administrators, the aforesaid sum of four thousand three hundred and twenty-five pounds by the instalments as provided for by the general conditions before mentioned.

Witness to the signature of employer, — George Gordon.
William Price.

Witness to the signature of contractor, — John Burke.
John Cropley.

CONTRACT FOR THE SUPPLY OF TERRA-COTTA.—*See Notes, p.* 424.

Contract entered into this twelfth day of June, one thousand nine hundred, between James Smith & Co. of Tamworth, in the County of Staffordshire, manufacturer of terra-cotta, hereinafter called the contractor, of the one part, and William Thompson, merchant, of Wood Street, London, hereinafter called the employer, of the other part as follows :—

1. In consideration of the sum of one thousand two hundred and forty pounds, to be paid to him as hereinafter mentioned, the contractor agrees with the employer, his executors, and administrators to supply and deliver before the first day of January, one thousand nine hundred and one, the whole of the terra-cotta as particularised by the accompanying specification, drawings, and details as signed by the contractor under the superintendence and to the satisfaction of George Smith, Russell Square, London, architect, or in case of his death of such other architect as the employer shall, by writing under his hand, appoint, and under and subject to the conditions of the specification, and also signed by the contractor.

2. And the employer agrees that, subject to and on performance by the contractor of this contract, the contractor shall receive and be paid, by himself or his executors or administrators, the aforesaid sum of one thousand two hundred and forty pounds by the instalments as provided for by the specification before mentioned.

Witness to the signature of employer,
WILLIAM GREEN. — WILLIAM THOMPSON.

Witness to the signature of contractor,
JOHN THOMPSON. — JAMES SMITH & Co.

INDEXING SPECIFICATIONS.

Usual Index.—The clauses having been numbered consecutively, the making of an index will be easy. The so-called index is often of very little use. It consists of a schedule of the clauses in the order they appear in the specification. Thus:—

1. Excavation.
2. Lime concrete.
3. Cement concrete, &c.

Alphabetical Index.—An alphabetical index may be made almost as readily, and will greatly facilitate reference. The writer should commence each item with the most important words. In some indexes one finds a great number of items beginning with an unimportant word like "brass" or "lead."

How to make an Alphabetical Index.—The general way is to cut up half sheets of foolscap transversely into slips about ¾ in. wide, then beginning at the first page of the specification write on each slip the subject of one clause, proceeding regularly thus through the whole of the pages. When they are all written they should be sorted according to their leading letter as, all the A's together, all the B's together. Then the items of each letter should be arranged in the dictionary method as *ab*, *ac*, *ad*, &c. When they are thus in order they may be written in that order on sheets of paper.

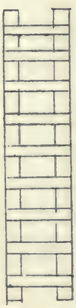


FIG. 65.

Or,

A second writing of the *draft* may be avoided by taking two slips of drawing foolscap, and pasting the written slips across them, after arranging them in the order desired, thus (Fig. 65).

SECTION VIII:

NOTES ON THE VARIOUS TRADES AND SPECIAL SECTIONS OF THE SPECIFICATIONS.

PRELIMINARY ITEMS.

Preliminary Items.—These are items which are not comprised by the conditions of the contract. They are those which apply to the materials and workmanship throughout the whole of the trades. They are the general technical stipulations of the intentions of the parties to the contract as distinguished from the strictly legal ones. It is obvious that such items will, if judiciously composed, save much repetition in the body of the specification.

Shoring.—If a building has existed on the site and it has been sold to a housebreaker, the agreement with him stipulates that he shall shore up the adjoining buildings, put up a hoarding, and strut up any part of the earth requiring support, and that the hoarding shall be the building contractor's property.

In London it is part of the district surveyor's duty to see that the shoring is properly done. In the country it will generally be the architect's duty.

The ordinary clause about shoring is usually sufficient without specific dimensions and scantlings of timbers, but sometimes shoring must be designed and carefully specified. The failure of a spire, a nave arcade, a bridge, a great chimney, or a house, are instances of what may happen.

Pulling Down and Credits.—As a general rule it will be found that the inclusion of the pulling down and credit of the old building, the shoring, and hoarding in the contract of the general contractor for the new building, is just as much to the building owner's pecuniary advantage as a contract with a housebreaker, and is an arrangement very much pleasanter for the architect.

Scaffolding.—The clause "supply all scaffolding, rods, stakes, and labour required in setting out the work" is sufficient for ordinary contracts, and this is generally supplemented by the clause:—

Afford Facilities.—"Afford facilities to any other parties employed upon the building, so that their works may proceed during the progress of the building, and give such persons the use of ordinary scaffolding and ladders."

Separate Contracts.—But in cases of a separate contract for a large quantity of structural metal work or roof glazing, as may occur in a large railway station or a similar building, the question of scaffolding admits of various arrangements which must be clearly defined.

Taking a separate contract for iron work, for example, the contract may comprise:—

A. 1. A provisional sum for the iron and fixing by a special contractor.
2. A stipulation in the specification that the contractor shall unload, get into building, hoist and assist in fixing   tons of iron joists, girders, and columns.
3. The general clause about scaffolding.
4. Painting such work by general contractor.

Or it may comprise:—

B. 1. A provisional sum for the iron, unloading, getting, in-hoisting and fixing by a special contractor.
2. That such contractor shall supply his own scaffolding.
3. That such contractor shall paint his own work.

The arrangement B. is generally more convenient than A.

In any separate contract for work which will form a part of a building to be done by a general contractor it will be necessary to prescribe such times for the delivery of the material as shall accord with the arrangements made for time of completion with the general contractor.

Tests.—All kinds of tests are prescribed in specifications, and in the majority of cases are not enforced; in small buildings they are rarely necessary. Whether they shall be inserted or not should be well considered, and it should be remembered that the more stringent they are the more difficult is it to get them done. They may either be described or a provisional sum may be inserted to cover the cost. When a sum is provided it is usually most convenient to stipulate for the carriage of the material in question to and from the testing-house.

PROVISIONS.

Provisions.—Work for which a sum is provided invariably costs more than if specified and drawn before a tender is obtained. In the cases of drainage, ironwork, and plumbing the advice of the specialist has to be paid for somehow, and accounts for the increase.

Provisions Cause Extras.—There is no more fruitful cause of extras than the beginning to build before the settlement of proper preliminaries, and this condition of things often makes provisions necessary. Extra work must be plentiful if a building is commenced while the drawings are mere sketches in pencil, without sections, roof plan, drain plan, or details, a practice by no means rare.

Position of Provisional Items in Specification.—The writer must decide whether he will put the whole of his provisions together in this part of the specification, or those relating to each trade at the end of the specification for such trade. It is more convenient to put them all together, as they are more easily found.

P. C. and List Prices.—In specifying from a trade list either deduct the trade discount and quote the price as P. C., or take the price without alteration from the list, and call it list price, but the same rule should be adopted throughout the specification. P. C. need not necessarily have a manufacturer's name stated. List prices should have it.

Trade Discounts.—The question of trade discounts and profits requires clear definition. At the settlement the production of invoices is the custom. Often these are no proof of what has been paid. A more reliable proof is the production of a receipted monthly statement, and this is often a stipulation of the specification.

Extent of Extra Work.—A provision for possible extra work depends mainly upon the kind of building. A new building on a new site should involve very little extra work. Structural alterations to an old building often develop most unexpected necessities. Foundations are often a cause of unforeseen expense, but this is often a consequence of neglect to investigate the quality of the ground. Sometimes the caprice of the building owner is the cause, sometimes the want of foresight, or absolute ignorance of the architect. The extras on a building should never exceed 10 per cent. of the amount of contract, and generally should not be as much as 5 per cent. General opinion as to an architect's responsibility in this respect may be gathered from the common

practice of architectural competitions, by which the architect binds himself to produce his building for an amount within 10 per cent. of his approximate estimate.

Provisions of Material.—Some architects who pride themselves on producing buildings without extras put at the end of each trade a provision of materials, such as "provide 100 yards cube of digging and carting," "provide 5 rods reduced brickwork in mortar," &c.

Works which are frequently Provisional.—The following works are often treated as provisional sums, usually based on a sub-contract :—

Extra works
Terra-cotta
Faïence
Quarry-worked stone
Constructional ironwork
Stoves and chimney pieces
Heating
Ventilation
Plumbing
Joinery in fittings
Ironmongery
Ornamental fibrous plaster work
Ornamental ironwork
Gasfitting
Electric bells
Electric lighting
Lifts
Lightning conductors
Ornamental glazing
Decorating
Machinery

In churches beyond the foregoing—

Reredos
Pulpit
Reading desk
Stalls
Altar rail
Bells
Organ

Attendance on Provisional Work.—Attendances on work for which a sum has been provided may either be described with such provision or may be included in that sum, or it may be arranged that the sub-contractor shall supply his own attendance and making good.

EXCAVATOR.

Nature of Soil should not be Specified.—The specification should not state the nature of the soil. By doing so the architect adopts an obligation which is not his.

Disposal of Surplus Earth.—The destination of the surplus earth must be clearly stated, and if the depth of any excavation is not clearly shown by the drawings, or cannot be inferred, it should be described.

Separation of Vegetable Soil.—If the earth is to be deposited on

the site state whether the vegetable soil is to be separated and separately deposited. If it is to be spread by the contractor this should be specified.

Datum.—The level of the ground floor and of the surfaces of the ground outside the building should be referred to a fixed datum, and the drawings or specification should make it clear whether the line shown as ground line is the original surface, or a finished or made-up one.

Grubbing Up Old Foundations or Drains.—When the new building is on the site of an old one reference should be made to the possible grubbing up of old foundations. On such a site, old drains, wells, or cesspools are of frequent occurrence. Old drains may either be taken up, or cleaned out and filled up with concrete pushed in from the ends, cesspools or wells emptied and filled up with dry rubbish or concrete.

Removal of Trees and Hedges.—When there are trees or hedges on the site their removal should be specified thus: "Fell the trees on the site of the proposed new building, and for a distance of 14 ft. beyond each way, and grub up their roots."

Removal of Rubbish from Old Basements.—When an old building has been pulled down, and the basement left full of rubbish, stipulate for the removal of the whole of the rubbish and foundations.

Contaminated Sub-soil.—Sometimes the whole site is saturated with sewage water, and then the whole of the offensive earth must be removed. In course of a substantial alteration of a town house some years ago the discovery was made that the whole site had been many years before a shoot for night-soil, afterwards concealed by a layer of earth and rubbish, and this earth and soil was of necessity removed. Such incidents show the necessity for careful examination. Where the architect has reason to apprehend a difficulty of this kind he usually makes a provision of concrete or digging, or both, something like the following:—

Provision of Material.—"Provide 10 yards cube of cement concrete as described, and filling in and ramming to old wells or cesspools."

Or,

"Empty any old cesspools or wells that may be met with, and fill in with hard dry rubbish or lime core (or concrete)."

"Provide 20 yds. cube cement concrete and ramming into old lines of drainpipes."

"Provide 50 yds. cube of excavation to basement, from 9 to 12 ft. below pavement level, including any necessary strutting and planking and carting away."

"Provide 100 yds. cube excavation in trenches from a depth exceeding 12 ft. and not exceeding 18 ft. from pavement level, including any necessary strutting and planking and carting away."

"Provide 100 yds. cube of cement concrete laid in foundations."

Level of Concrete under Floors.—If the drawings do not clearly show the surface of the concrete beneath the boarded floors it should be described in the specification.

Foundations.—If the nature of the soil is not well known trial holes should be dug before drawing the sections.

Bearing Power of Soils.—There are various practical tests of the bearing power of soils. The simplest is a platform upon which weights may be piled, with four legs each about 12 in. by 12 in. This may be placed upon the bared stratum upon which it is intended to build, the weights applied, and careful notes taken of the extent of its subsidence.

Extra precaution must be observed when it is intended to erect a heavy building on ground much above the level of a public way and close to it or on an inclined stratum of clay on the side of a hill or near to a deep excavation. In such cases there is danger that the weight may force the earth out laterally and so damage the building.

Very soft earth may be unequal to the support of a building, and may extend to a great depth. Various expedients have been adopted in such cases. The most sensible practice is excavation until a solid bottom is found, and building up from that or filling up to the general level of the foundations with concrete. Piling and planking has been used, but is rarely adopted now.

Tall Buildings should not be Attached.—It will be seen by the following table that there is not much need for apprehension with buildings of ordinary height. Church, water, and other high towers, manufactory chimneys, and buildings of many storeys require more careful consideration. When adjoining a building of moderate height these tall buildings should be detached, as the unequal settlement is likely to break the connection.

A foundation on rock should be prepared by removing all those parts of its surface which are loose or decayed, and filling up the irregularities with cement concrete. Sometimes the surface may be stepped with advantage.

Table of the Bearing Power of Soils.

Kind of Materials.	Safe bearing power in Tons, per square foot. Minimum.	Maximum.
1. Rock, the hardest, in thick layers, native beds ...		
2. ,, equal to best ashlar masonry	25	30
3. ,, equal to best brick	15	20
4. ,, equal to poor brick	5	10
5. Clay, in thick beds always dry	4	6
6. ,, in thick beds moderately dry	2	4
7. ,, soft	1	2
8. Gravel and coarse sand well cemented	8	10
9. Sand, compact and well cemented	4	6
10. ,, clean dry	2	4
11. Quicksand, alluvial soils	0·5	1

A stratum of gravel sufficiently hard and deep to support a building is sometimes unnecessarily removed and filled up with concrete.

Foundations on clay or chalk should be dug sufficiently deep to escape the influence of temperature, otherwise, in very hot seasons the building will suffer, as in 1887, when many buildings on clay foundations were injured by settlements.

When the public sewers are below the level of the supporting stratum they will keep it dry. If it is subject to occasional soaking the water may be diverted, either by new channels or draining by agricultural drains.

Weight on London Clay.—The London clay is frequently and safely weighted up to 4 tons per superficial foot.

Sheet Piling.—In the case of the softer clays and other compressible soils, which cannot be removed, it may sometimes be expedient to enclose the whole site by sheet piling (Fig. 66), driven with close joints, or, in special cases, birdsmouthed.

FIG. 66.

Piling and Planking.—Piling and planking is seldom combined in modern practice. When it is the piles are commonly 12 in. by 12 in., about 30 in. from centre to centre, driven into the hard soil, and covered with 3 in. planks, and upon the planking the concrete is laid.

The common practice in compressible soil is to drive the piles sharpened, but unshod, until they penetrate the hard

stratum beneath, the tops of the piles being embedded about 12 in. in the concrete of the footing. It is necessary to prescribe to what extent they shall be driven into the hard bed, in some such way as follows :—

"The piles shall be driven into the hard stratum until they do not move more than half an inch under the blow of a hammer of two thousand pounds weight falling twenty-five feet at the last blow."

Weight of Ram.—The weight of the ram is commonly 15 cwt. for the larger piles and about 10 cwt. for the smaller piles and sheet piles. It is a general principle to use a heavy ram with a short fall rather than a light ram with a long fall, as there is less danger of splitting the piles.

Rules for Bearing Piles.—Rankine's empirical rule for the maximum load on bearing piles—*i.e.*, those driven into a firmer stratum below a soft one—is 1,000 lbs. per square inch of section ; for friction piles—*i.e.*, those which depend on the friction of the soil they are driven into—200 lbs. per square inch. This on a 12 in. by 12 in. pile represents about 64 tons and 13 tons respectively. These are rough approximations to the safe load, but in the case of friction piles their length and the nature of the soil are factors which this rule disregards. About one-fifth of these weights should be adopted as the safe load.

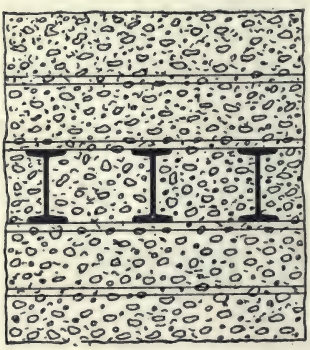


Fig. 67.

The safe load under various circumstances for a pile 12 in. by 12 in. and 20 ft. long, may be taken as follows :—

If driven in loose sand, 2 tons.

If driven in compact sand, 2½ tons

If driven in hard clay, 5 tons.

If driven into a hard stratum like gravel, into which it penetrates ½ in. at the last blow of a ram weighing a ton, 16 tons.

Another method in very soft soils is to carry down the work to the hard stratum in iron caissons pneumatic, hydraulic, or otherwise.

Another method of forming foundations (Fig. 67) which is largely used in America is the covering of the whole surface of the site with a thick layer of concrete, strengthened by embedded steel rolled joists. Sometimes several tiers of joists crossing each

other are used. Upon this general bed the weight of columns or stanchions is spread; very ingenious devices for the distribution and equalization of weight over an entire site are common.

The joists before laying should be cleaned, heated, and coated with gas tar.

An illustration of the American practice of grillage may perhaps prove useful. There is very little doubt that modifications of it will be used in England with increasing frequency.

The following is an extract from Birkmire's "Planning and Construction of High Office Buildings."

Total safe load on a single beam in tons of 2,000 lbs. for the following values of L—B.

L = length of beam in feet.
B = length in feet over which superimposed load is distributed.

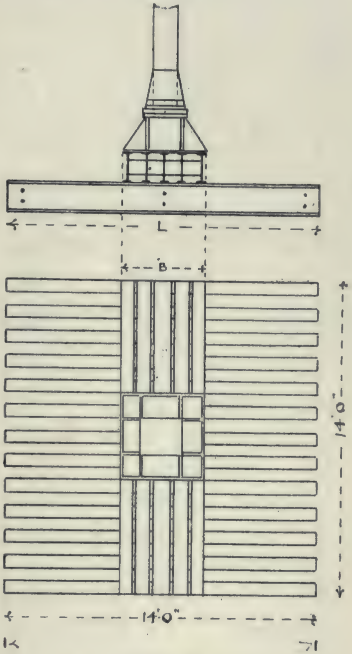


FIG. 68.

To illustrate the application of the table, take a foundation

Beam.		Unloaded length of Beam L—B in feet.										
Depth. Inches.	Weight. lbs. per foot.	5	6	7	8	9	10	11	12	13	14	15
20	90			115	100	89·2	80·3	73·0	66·9	61·8	57·4	53·6
20	80			102	89·6	79·8	71·7	65·2	59·8	55·2	51·2	47·8
20	64			87·5	76·8	68·1	61·3	55·7	51·1	47·1	43·8	40·9
15	60			64·8	56·6	50·4	45·4	41·2	37·8	34·9	32·4	30·2
15	50			53·8	47·0	41·8	37·7	34·2	31·4	29·0	26·9	25·1
15	41			43·7	38·2	34·0	30·6	27·7	25·5	23·5	21·9	20·4
12	40		41·6	35·8	31·3	27·8	25·0	22·7	20·8	19·2	17·9	16·7
12	32		32·6	28·0	24·5	21·8	19·6	17·8	16·3	15·1	14·0	13·1
10	33	34·4	28·6	24·6	21·5	19·1	17·2	15·6	14·3	13·2	12·3	11·5
10	25	26·2	21·8	18·7	16·3	14·5	13·1	11·9	10·9	10·1	9·3	8·7
9	27	26·2	21·8	18·7	16·4	14·6	13·1	11·9	10·9	10·1	9·4	8·7
9	21	20·0	16·7	14·3	12·5	11·1	10·0	9·1	8·3	7·7	7·1	6·7
8	18	15·1	12·6	10·8	9·4	8·4	7·6	6·9	6·3	5·8		

carrying a load of 400 tons on a soil capable of carrying 2 tons per square foot. The required area of the footing will be 200 square feet. If a square footing is used, a square with 14 ft. sides has an area of 196 square feet, and will be assumed as ample. The upper layer of beams will be proportioned first. The base plate resting upon the upper layer will be assumed as 4 ft. square; then in this case B is 4 ft., L is 14 ft., and L—B 10 ft. The upper layers will be assumed to consist of five beams, as this number is the greatest that will provide sufficient space between the flanges of the beams to permit satisfactory ramming of the concrete filling. Each beam will take $\frac{1}{5}$th of the total load or 80 tons. By referring to the table a 20 in. 90 lbs. beam has a safe load of 80·30 tons when L—B is 10 ft. The upper layer will therefore consist of five 20 in. 90 lbs. I beams.

In the under layer, in this instance L and B have the same value as the upper layer. If the beams are spaced about 12 in. on centres, there will be fifteen beams in the layer, each carrying $\frac{1}{5}$th of the total load, or $26\frac{2}{3}$ tons.

The lightest beam by the table is a 15 in. 42 lbs., which has a safe load of 30·6 tons. A less number of beams can therefore be used.

Thirteen 15 in. 42 lbs. beams will provide for the total load within a small amount which, considering the nature of the load, can be neglected. Where two columns carrying unequal loads rest upon the same grillage, care should be taken to have the centre of gravity of the grillage coincide with the point of application of the resultant of the loads on the columns in order to secure uniform pressure on the footing.

Tables of Weights on a Foundation.—In the case of a heavy building the weights of the roof and floors, and the weights they are required to sustain, the weight of the walls, and the weights to be supported by the columns or stanchions should be carefully calculated, so that the architect may decide what his foundations may have to bear. The results should be carefully tabulated and preserved for reference during the progress of the work. Examples of these tables may be found in Vol. 28 "Proceedings of the Institution of Civil Engineers," Shankland on "Steel Skeleton Construction."

Measures for Ingredients of Concrete.—When concrete forms an important element of a building, its composition and mixing should be carefully described thus:—

The materials for concrete shall be measured with proper

measures, twice turned over dry on a wooden platform of sufficient size, and thoroughly mixed. The water shall then be added from a can or rose head with fine holes, and in no other way. The materials shall then be turned over a sufficient number of times until thoroughly incorporated, and immediately deposited.

Lime Concrete.—Describe the proportion of lime, ballast, and sand, the maximum size of the stones, the kind of lime, whether the concrete shall be shot into trenches, whether rammed in layers, and if the drawings are not clear, the width and depth of concrete to each description of walls.

Describe the thickness and kind of concrete under the various pavings. When several kinds of concrete occur in one building the position of each kind should be clearly described. If there are only two kinds it will sometimes be sufficient to specifically describe the position of one kind of concrete, and state that the remainder will be of another kind.

Cement concrete is the best, but its expense is often prohibitive. It should invariably be used for underpinning, and as a general rule under tile and cement pavings. For ordinary foundations lime concrete is the rule, and is generally sufficient; in wet or soft foundations lias lime concrete is often used. The best results are obtained by filling in the concrete in layers and ramming it.

It is advisable to use cement concrete rather than lime under cement pavings.

Rubbish.—Where surface digging is necessarily carried down far enough to require it, or where the natural surface slopes, it will often be necessary to fill in rubbish to receive the concrete. It should be hard material and well rammed.

Drains (as Provision).

Provision for Drains.—To the heading of this section is often added the above words in parentheses. The original intention is so often varied that some architects habitually treat this work as a provision. In any case a drain plan should be made before the quantities are prepared or the work submitted to tender.

Identification of Inspection Pits.—In the case of an extensive system of drainage the inspection pits should be designated by consecutive numbers or letters. These make the description clearer.

Separation of Soil and Rain-water Drains.—When there is a separate system of drains for soil and rain-water respectively,

it will be found convenient to keep the description of each system separate.

This separation is insisted upon in some towns and in some suburbs of London. The byelaws of the town or local board should be consulted in all cases.

A separate rain-water system either runs into a natural water course, or the rain-water may be stored in a rain-water tank, from which the water may be pumped directly into pails by a pump immediately over it, or delivered over a scullery sink with a pump adjacent thereto.

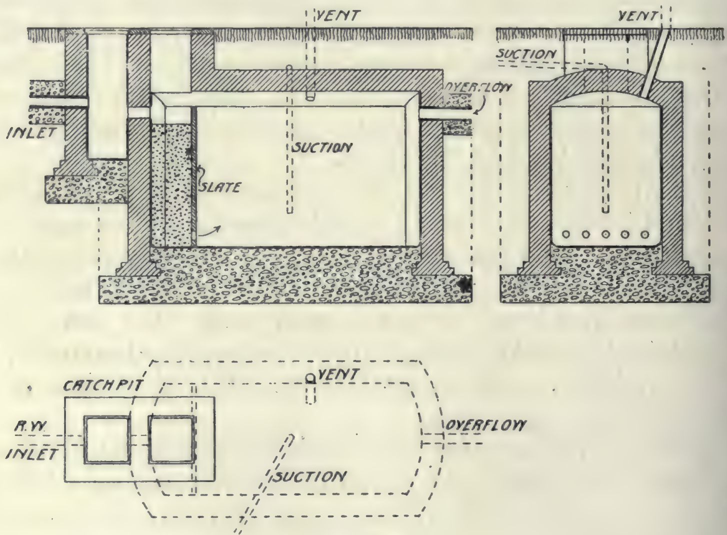


FIG. 69.

Rain-water Tank.—Sometimes the rain-water gutters and pipes are arranged to deliver the rain-water into a tank in the upper storey of the building, the water in such case being delivered by a pipe and tap to the lower part of the house.

A rain-water tank (Fig. 69) is best described as a separate section in all trades as follows :—

Rain-water Tank in all Trades.—" Construct rain-water tank to detail in the position shown by plan of drains.

" Lay cement concrete as described as shown by drawing. From the bottom of footings to the top of the brickwork puddle the whole of the external faces of the tank and the catchpit with thoroughly plastic well-tempered clay for a thickness of 12 in.

" Build the brickwork in cement. Supply $1\frac{1}{4}$ in., sawn and

rubbed both sides, slate division in a single slab built in at each end 4 in. and sunk 3 in. into the concrete at bottom. Cut a square hole near the bottom 6 in. by 4 in. Fill the space between the slate and the catchpit with animal charcoal broken small, and clean washed gravel in alternate layers. Render and trowel 1 in. thick with Portland cement and sand in equal proportions the bottoms and sides of the tank and the catchpit. Carefully connect the inlet and outlet drain with the brickwork.

"Supply a 4 in. finely tooled York cover in one stone with two square perforations 21 in. by 21 in.

"Supply two galvanized wrought-iron covers (P. C. 35*s*. each at manufactory), and fix and run with cement.

"Supply 3 in. galvanized iron heavy rain-water pipe, the joints caulked with tow and molten lead, as ventilating pipe, from the tank to the eastern wall of kitchen, to be carried up the wall to a height of 4 ft. from the ground.

"Carry 6 in. drainpipe as overflow into the pond on eastern side of house."

Pipes.—The pipes may be ordinary stoneware pipes, or they may be tested. A maker may be prescribed. They may be London made or not, they may be jointed in cement, and the joints puddled around with clay or embedded in cement concrete for half their depth, or entirely enveloped in cement concrete. They may have Stanford's patent joints, Doulton's patent self-adjusting joint, or Doulton's patent composite joint, but neither of these three are necessary if the pipe is enveloped in concrete. The ideal arrangement is the running of every branch into an inspection pit, or providing such branch with an arrangement at its higher end, through which a rod may be pushed as far as the main drain. For this purpose Stokes's registered gulley traps are convenient (Fig. 70), or where the branch terminates at the foot of a rain-water pipe Winser's improved rain-water shoes.

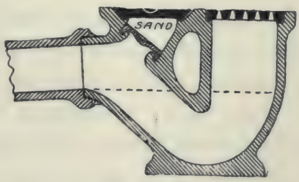


FIG. 70.

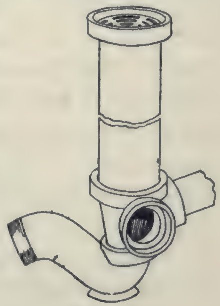


FIG. 71.

Where a rain-water drain runs into a soil drain Winser's rain-water disconnector (Fig. 71) is often inserted near the junction for the escape of any effluvia.

A junction with its mouth turned upwards, and fitted with an earthenware stopper, is another expedient for the cleaning of a drain. This may be covered with a piece of stone or built into a small brick chamber with a stone cover.

Description of Pipes.—Describe quality, amount of fall in 10 ft., jointing, if patent joints, whose patent, whether to be left open after laying until inspected. If to be tested, what test. If bedded in concrete, state its kind, and extreme size as 16 in. by 16 in., 18 in. by 18 in., &c.

"The pipes to be glazed stoneware socketed pipes of Lambeth make, jointed by having the back part of the sockets filled with hemp gasket to a depth of not less than 1¼ in. from the front of socket, the socket then filled solidly with Portland cement gauged with an equal volume of Thames sand, and a fillet of the same composition formed round the outside of the socket."

Size of Pipes.—These should be figured on the drain plan and thus referred to:—

"The pipes to be of the sizes figured on the plans, with all necessary bends, junctions, taper pieces," &c.

Pipes should be laid in straight lines from point to point, and curves should on no account be made with straight pipes.

Inspection Pits.—These should be large enough for the easy use of the rods for cleaning the drains. They are best built in cement, but are often built in mortar. The brickwork should be 9 in. thick, sometimes but rarely they are built 4½ in. thick. They may have their inside merely struck fair, or lined with glazed bricks, or rendered in cement. The benching may be in brick, in cement, or cement concrete, but the slopes should be rendered with cement. The face of all cement work should be well trowelled. The main channels should receive the branch channels at the level of the invert rather than over the edge, there is less splashing, and the main channel should have a fall steeper than the general fall of the drains; 3 in. in the length of the pit is a common stipulation. Sometimes the outside of the brickwork is roughly rendered with cement to exclude surface water. When the pit is more than 3 ft. in depth step-irons will be necessary. The size of the cover is usually much less than the size of the pit; it is consequently necessary to oversail for it or to cover part of the pit with stone or an arch. The iron cover may be either bedded on the brickwork or let into a stone cover. The cover, if outside the building, need not be airtight, if inside, it must be. They may be obtained with their ironwork sunk

to receive wood block, stone or cement paving for outside work, or tiles and concrete for inside work.

Describe the brickwork and its extreme width and breadth in clear (ignore the depth), whether in mortar or cement, whether struck joint, brick facing or rendered with cement inside, depth of concrete on which the brickwork stands, and whether lime or cement, the benching, the channels, the chute, if any, whether the channels are glazed stoneware or white enamelled, or if patent, the name of the patentee. Describe the cover by a number in a trade list, by P. C. or list price.

Cesspools.—Cesspools are rarely used except in the country. When in chalk, sand, or porous earth, they are frequently steined dry, in other cases they are built in cement. Generally they are circular on plan. They should be 9 in. thick, and domed over of the same thickness of brickwork in cement. They should have a paved brick bottom and an eye in the dome for emptying, a stone cover, which is sometimes fitted with a pump, and the water used for irrigation. There should be an overflow, which is generally taken to an adjacent watercourse. Sometimes the local authority will not permit this until the water has been purified, and this involves a filtering bed. Any water which can be otherwise disposed of should be kept out of the cesspool.

Describe the thickness of the brickwork, whether in mortar or cement, the size in clear, the top, the cover, the paving, the concrete, the pump.

Gulleys.—Of these there is a great variety. They are best described by number from a trade list, stating the name of the maker, how fixed, and whether bedded in lime or cement concrete.

Sometimes instead of a yard gulley a small brick pit is built, upon which a gulley grating is laid. State the thickness of the brickwork, the size of the pit in clear, the length, width, and depth, the concrete on which the brickwork stands, the paving, whether the inside is rendered in cement or struck joint, the gulley grating and frame by a number from a trade list.

Grease Traps.—The old-fashioned grease trap, a brick pit with a dip stone and a York cover, has been entirely superseded by the special contrivances of the sanitary engineer. These are best described by a number from a trade list. State what it is bedded in, and stipulate for the delivery of the waste under and not over the grating.

There are two kinds, one a grease trap, which receives the waste and delivers all but the grease into the drain, the other (Fig. 72) connected with a flushing tank, which frequently discharges, breaks up the grease, and washes it away before it can clog the drain. (See "Description," page 48.)

FIG. 72.

An ordinary grease trap is described as follows. There is a great variety of this type in the market.

"Supply and bed in cement concrete 6 in. thick all around in kitchen yard to receive the waste from butler's pantry sink (Fig. 73), Dent and Hellyer's (Newcastle Street, Strand) No. 36 medium size extra strong vitrified stoneware grease-intercepting trap 20 in. by 13 in. by 14½ in. deep, fitted with galvanized cast-iron cover for access to drain, and galvanized cast-iron cover with india-rubber packing, and cast-iron lifter. Connect with waste and drain."

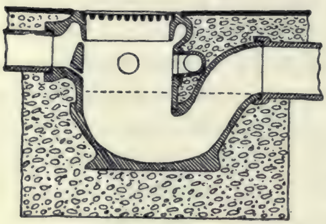


FIG. 72A.

Iron Drains.—Iron drains are used more especially to convey drainage under buildings. They should be treated with Dr. Angus Smith's solution inside and out, and although jointed with blue lead should be embedded in concrete. When expense is unimportant they are used by sanitary experts for an entire system, both inside and outside of the building, the channels and bends in the inspection pits being also of iron to match.

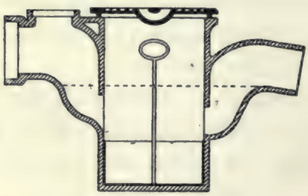


FIG. 73.

Agricultural Drain.—The site of a building is sometimes charged with surface water, and it will then be necessary to drain it.

"Dig trenches 10 ft. apart in parallel lines and of an average depth of 4 ft. over the whole surface of the site and 10 ft. beyond each way. Lay therein 2 in. agricultural drain with a fall from north to south."

French Drain.—"Dig, to receive the agricultural pipes, a trench

5 ft. deep, 2 ft. wide at top, and 18 in. at bottom (Fig. 74), 10 ft. from the southern wall, and fill it up to the level of 18 in. below the general surface with local rubble broken to a uniform size to pass a 2 in. ring, and covered with the earth excavated. This trench shall extend westward from the south-eastern angle of the area drained as far as the ditch on the western side of the site."

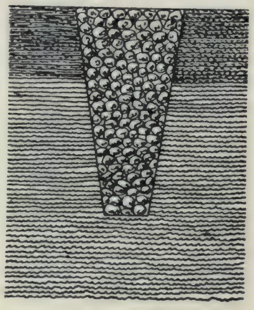


FIG. 74.

PILING AND PLANKING.

Wooden piling and planking as a foundation is now rarely used. It has been superseded by excavation down to a solid bottom and filling up with concrete, or a grillage of iron joists and concrete, forming a complete platform, or a system of iron tubes carried down to a solid stratum filled in with concrete, and supporting a bed of concrete to receive the walls. Piling and planking may, however, be described in the following manner:—

Piling and Planking to Western Wall.—" Support the foundation of the western wall for its whole length by fir planks 3 in. thick spiked to the tops of the piles, and three rows of piles 30 in. from centre to centre. The piles to be 12 in. square and 15 ft. long, each shod with a wrought-iron shoe, with four straps 18 in. long, measured from the point of shoe, and spiked with twelve 4 in. spikes, weight 30 lbs. in all. Supply hoops for driving.

" The piles to be best middling Dantzic, sawn die square from straight trees, all the piles and planking to be creosoted under pressure after squaring with 8 lbs. of creosote to each cube foot of timber. All cut ends of planking and the tops of piles to be tarred with Stockholm tar."

BRICKLAYER.

Bricks.—Before writing a specification the architect should find out what bricks are available in the neighbourhood of the proposed building and their cost. Bricks are sometimes brought from a long distance, and are often not so good as those obtainable at local brickfields. If they are to be equal to the support of a great weight the architect should have them tested.

For the support of great weights blue Staffordshire bricks are often used.

If the architect wishes the bricks to be supplied by a particular maker or from a particular field he must specify it, and if he wishes to provide against the use of bats he must define the extent.

Lime.—Describe whether stone, chalk, flare; if lias or other hydraulic lime, say where from.

Sand.—Describe. Washed sand is best. In London Thames sand is always to be preferred. In the country the sand will be pit sand, and washing would add considerably to the expense. If the architect knows of sand in the neighbourhood of which he approves, he should specify it. Sometimes in districts where sand is scarce engine ashes are substituted entirely for sand or mixed with the sand.

Cement.—Describe. Say how many pounds per bushel it shall weigh. It is safest to prescribe a manufacturer whose cement you approve. If a test is required it must be described. Sometimes a sum is provided for the testing of materials.

Mortar.—Describe its composition, and whether mixed in a mill. If selenitic, stipulate that it shall be mixed in accordance with the company's printed instructions. If of cement, state the proportions of cement to sand.

Brickwork.—Describe the bond, the height of four courses and four joints, the maximum height to which brickwork may be carried up beyond any adjoining brickwork. State if flushed up at every course.

Brickwork as Backing to Masonry.—Brickwork in backing to masonry is built sometimes in mortar sometimes in cement. A backing of brickwork in cement usually produces unsightly stains on the faces of the stones, and some architects to prevent this have plastered the backs of all stones which have brick backing with a coat of fine plaster.

Hollow Walls.—State clearly which thickness shall be external (it should be the thinner one), the width of the cavity, what bonders, and how many to each superficial yard of wall. State how the rubbish and mortar shall be kept out of the hollow.

Underpinning.—Describe where, and whether the old footings are to be cut off or entirely removed. It is best to describe underpinning in a separate section comprising all trades.

Brick Partitions.—Half-brick partitions are nearly always built

in cement to give them additional strength. Some architects build in a tier of stout hoop iron at every course, and when in the ground floor they should be supported by a 9 in. wall in mortar built up to the level of the ground floor.

Brick-nogged Partitions.—Brick-nogged partitions are objectionable because of the burning of the timber in them in case of fire. They may be described as follows:—

"Build the brick-nogged partitions in cement with fir heads and sills $4\frac{1}{2}$ in. by 3 in., quarters 2 ft. 3 in. apart, nogging pieces every eight courses in height $4\frac{1}{2}$ in. by $1\frac{1}{2}$ in."

Footings.—If in the metropolitan area they may be described to be in accordance with the Building Act.

If in the country the intentions as to them for the various thicknesses of walls may be stated.

Some architects make the bottom course of footings 6 in. high.

Sleeper Walls.—State thickness, and whether built solid or honeycomb. If the width of the footings is not increased because of them say so, or let it be clearly shown by the drawings. If they are built up from the surface concrete under the wooden floors say so or show it on the sections.

Plinths.—State whether plinths shall increase the width of the general footings.

Arches.—Describe arches over lintels or voids, state any variations of depth for various spans.

The arches of face work are best described with the facings.

Work in Cement.—The sand used for cement work should always be washed. The architect may save description if he will colour on the plans with a special tint or etch all the parts which he desires to have built in cement.

The following works are often built in cement, all piers not exceeding a certain superficial area, the course of brickwork above and below the damp-proof course, the parapets, the four topmost courses of external walls, the topmost courses of chimney shafts, the chimney shafts from above the roof to the top, the area walls, retaining walls, cores for columns, relieving arches over voids or recesses, the courses in which hoop iron is laid, including the course above and below, the work in additions to an old building, the work in filling up old openings, vaulting under public ways, brickwork in underpinning, trimmer arches.

Use of Blue Staffordshire Bricks.—Although the use of cement

strengthens the work considerably such strength will at times prove insufficient. In such a case harder bricks may be used. Piers or parts of an ordinary wall may be built in blue Staffordshire bricks and cement.

Thickening or Facing Up Old Walls.—The facing up old work should be in cement, and it should be described as thoroughly bonded thereto.

The thickening of old walls should be in cement, and the bonding described somewhat like the following:—

"Face the old wall with brickwork in cement (Fig. 75), five courses of stretchers built against the wall and three courses of headers cut and bonded into the old work alternately as sketch."

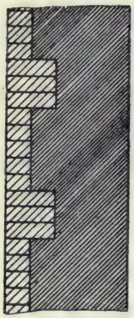


FIG. 75.

Fires.—The whole of the work to the fireplaces is best described together. Describe chimney bars, their size, and how much longer than the width of the opening, parget and core flues, and whether cow dung shall be used, trimmer arches and their springers, the fender walls, the setting of the stoves, ranges, and coppers, the chimney pots, bafflers, windledges, flue plates, soot doors, flue pipes.

The brickwork around kitchen flues should be 9 in. thick the whole way up. Chimney pots or bafflers may be described by a number from a trade list. Flue plates are convenient for saving space between smoke flues, and when used between smoke and ventilating flues assist an upward current in the latter.

Flue Pipes.—Flue pipes should be described by their diameter, and as of unglazed terra-cotta set in cement with special made bends to match.

Soot Doors.—Soot doors may be described by a number from a trade list.

Sweeping Flues.—Where expensively decorated rooms occur a separate sweeping flue is designed with access by a soot door on the outer face of the wall.

Chambers behind Stoves.—In the case of a stove with an air chamber formed in the brickwork behind it when next an external wall, the air would be admitted by an air brick on the outer face of the wall. When the fireplace is on an internal wall air would be conveyed to the chamber by drainpipes from

the nearest external wall with a grating at the mouth of the pipe, described thus:—

"Supply air to the chambers behind the ventilating stoves adjoining external walls by a 9 in. by 6 in. cast-iron ornamental air brick, and form opening through the wall and render with cement."

"Supply air to the chambers behind each of the ventilating stoves adjoining internal walls by a 9 in. by 9 in. cast-iron ornamental grating, in the outer face of the nearest convenient external wall form opening as before, and convey the air from thence to the chamber by 9 in. stoneware drainpipe jointed with cement, laid on the concrete beneath the floors or embedded when the pavings occur. Supply any requisite bends in the pipe."

When the stoves in a similar position to the last are on upper floors the air may be conveyed by a zinc tube instead of a drainpipe.

"Supply air to the chambers behind each of the ventilating stoves adjoining internal walls by 9 in. by 9 in. cast-iron ornamental grating, in the outer face of the nearest convenient external wall, form opening as before, and convey the air from thence to the chamber by a 12 in. by 6 in. soldered tube of No. 16 zinc, thoroughly airtight, and with all necessary bends, secured to the joists by bands of similar zinc or wooden bearers. Trim the joists where necessary for its passage."

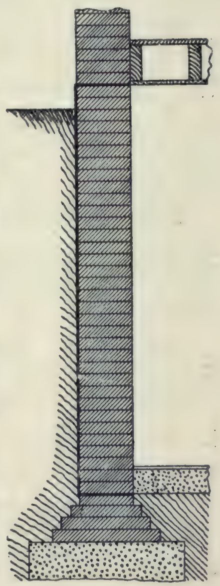


FIG. 76.

Damp-proof Courses.—These may be of asphalted felt, a mixture of pitch, tar, and sand, mineral asphalte, Seyssell asphalte, two courses of stout slates in cement.

They are used on walls ordinarily between the surface of the ground and the ground floor, sometimes on parapets immediately below a stone coping.

Sometimes two damp-proof courses are used (Fig. 76), one just below the level of the basement floor, the other just below the level of the ground floor, the upper and lower ones connected by a coating of asphalte on the outer face of the wall, as sketch.

Some architects use a damp-proof course to all chimney stacks immediately above the level of the surface of the roof.

Bed and Point Frames.—State if pointed with cement, if screeded with lime and hair, or merely bedded in mortar.

Hoop Iron.—This is not so much used as formerly. It was partly an antidote to insufficient mortar, a defect of which architects are more generally aware. Tarring and sanding is unnecessary; the cement preserves it from rust.

A common practice is to lay two tiers under the plates of the upper storeys and the roof, one row to each half brick in the thickness of the wall. Sometimes a further line of two tiers is introduced midway between each two of the upper floors. One tier of two rows of stout hoop iron about 2 in. by $\frac{1}{8}$ in. is sometimes used instead of a wooden plate for floors where there is no set off of the brickwork to receive it. A wooden plate built into the wall often causes its fall in case of fire.

Air Bricks.—A certain number is commonly provided, and they are fixed where directed. They are used commonly to ventilate the space under wooden ground floors. Sometimes they are used to ventilate the cavity of a hollow wall, fixed 10 or 12 ft. apart at the base and top of the cavity on the outer face of the wall.

When specially heavy ones are desired they should be more specifically described than usual, or they may be selected from a trade list. Iron or terra-cotta air bricks can always be selected from a list.

Cast-iron Air Gratings.—These are best described from a trade list by a number.

Iron Corbels.—The support of the plates of roofs or floors which it may be desirable to keep out of the walls may be by cast- or wrought-iron corbels, which may be described either by weight or size, or by brick oversailing courses.

Levelling up in Iron to receive Brickwork.—This may be by tooled or self-faced York stone. When the girder is riveted, in addition to this, the top of the upper flange is levelled up with plain tiles and cement.

Quoins of Quadrant Section and Harder Bricks.—These are exclusively for unplastered walls. Quoins of this section are sometimes made in the ordinary bricks. They may be obtained in Fletton bricks, but where harder ones are required they would be of Burham, Suffolk, or Staffordshire manufacture.

Pavings.—The lowest floor of a town house is better all paved than floored in the ordinary way. So many houses become

infested with beetles shortly after they are built, and spaces under floors afford them harbour.

Cement Pavings.—It is not advisable to lay cement paving on lime concrete. Sometimes when cement concrete is used the surface is finished fine, and forms a part of the thickness, described thus:—

"Lay the floor of basement with cement concrete 6 in. thick, finished with a fine cement floated surface." When a definite thickness of cement paving is specified it should not be less than 1 in. thick.

Cement pavings with a floated or trowelled face are suitable for domestic offices and common hearths.

Floated Surface.—Cement floated face should be not less than $\frac{3}{4}$ in. thick, sometimes described as screed. It should be used under tile, mosaic, asphalte, and wood block pavings. Cement floated face of a similar thickness should be specified as a backing to wall tiling and faïence.

Tile Pavings.—It is advisable to define the quality and kind by reference to the trade list of a particular manufacturer, quoting the price per yard at the manufactory. For tile hearths a P. C. sum for each is generally most convenient.

Asphalte Paving.—The cheapest asphalte is known as mineral asphalte. It is a mixture of gas tar, chalk, and sand. It is used for damp-proof courses and common paving.

If real asphalte is required it will be necessary to specify the name of a company, and to stipulate that it shall be laid by the company's own men.

The mineral asphalte is used commonly $\frac{1}{2}$ in. thick for damp-proof courses, 1 in. thick for common pavings.

The better asphalte is used for damp-proof courses, linings of tanks, covering of floors, roofs, and roads, and facing of walls. The usual thicknesses adopted are as follows:—

Floors and roofs and their flashings or skirtings, $\frac{3}{4}$ in.
Lining of tanks, $\frac{3}{4}$ in.
Goods warehouses, $1\frac{1}{4}$ in.
Stables, $1\frac{1}{4}$ in.
Breweries, $1\frac{1}{4}$ in.
Slaughter houses, 1 in.
Markets, 1 in.
Laundries, 1 in.
Roads, $1\frac{1}{2}$ or 2 in.

In all cases, except damp-proof courses, the asphalte should be laid in two thicknesses.

Describe the channels and outlets.

Tar Paving.—This is usually sublet. The School Board for London makes tar paving the subject of a separate contract, which includes a period of maintenance.

$2\frac{1}{2}$ in. paving is the ordinary thickness used for playgrounds and footpaths. It is best made with some kind of limestone broken to $1\frac{1}{2}$ in. cubes.

Tar paving may be laid on a bed of hard, dry rubbish or gravel 6 in. thick.

Patent Cement Pavings.—There is a variety of patent cement pavings. The greater part of them are made of Portland cement, granite dust, and granite chippings in various proportions. The surface where there is liability to slipping is grooved. They are laid either on concrete, gravel, or hard, dry rubbish. They are suitable for stables, coach-houses, stable yards, railway stations, warehouses, breweries, abattoirs, and other places where rough wear may be probable. They are all laid *in situ*, and should be done by the company's own men. Their great recommendation is the absence of joints.

Stable paving should be 2 in. thick, when for heavy draught horses 3 in. thick.

These pavings may be laid on a 4 in. to 6 in. bed of hard brick or stone, broken to a uniform size of about 2 in. cubes, or gravel stones of similar sizes. This should be rammed, and when the ground is soft the surface should also be rammed.

The chief makers of such paving are:—

W. B. Wilkinson's, Newcastle-on-Tyne.

The Victoria Stone Co.

B. Ward & Co., 15, Great George Street, Westminster.

Stewart's Granolithic Stone Co., Regent's Dock, Limehouse.

Patent Paving and Construction Co., 5, Westminster Chambers, Victoria Street, W.; and others.

Brick Pavings.—Blue Staffordshire bricks, 9 in. by $4\frac{1}{2}$ in. by 3 in., or 9 in. by $4\frac{1}{2}$ in. by $2\frac{5}{8}$ in., make strong and durable paving. They vary in quality. Many of them are only partly vitrified, in bad cases a mere thin skin of blue and the interior red. Stipulate for complete vitrification of the bricks. The ordinary pattern may be used for the paving of coal cellars and yards, lining of coal shoots, &c., either flat or on edge, and grouted

with cement. Blue Staffordshire bricks, with a pattern on one face to make them less slippery, and mostly 2 in. thick, are used for footpaths, platforms of railway stations, and similar positions. They should be specified by number from a trade list. Those commonly used for stables are panelled in divisions of various size, and are $2\frac{5}{8}$ in. or 3 in. thick (Figs. 77 and 78). Smaller sizes are made either plain or chamfered all around the upper face, 6 in. by $2\frac{1}{2}$ in. by $2\frac{1}{2}$ in., 6 in. by $1\frac{3}{4}$ in. by $2\frac{1}{2}$ in. (Fig. 79), 9 in. by $4\frac{1}{2}$ in. by 3 in., grooved parallel with their length (Fig. 80).

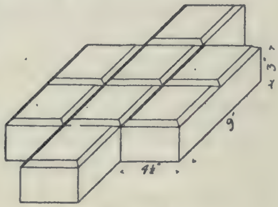


FIG. 77.

Yellow adamantine clinkers $6\frac{1}{2}$ in. by $1\frac{3}{4}$ in. by $2\frac{1}{2}$ in., chamfered either on two or four upper edges, make the best, cleanest, and most expensive paving for a stable.

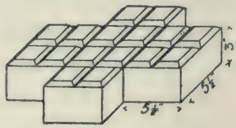


FIG. 78.

Facings.—Facings are most conveniently treated as a separate section of the specification.

A tint allotted to each kind of facing on the elevations assists the specification.

If there are several kinds of facing proceed in the same manner for each kind, keeping each separate—*i.e.*, say all that is to be said about picked stock facings, then red, then glazed, &c.

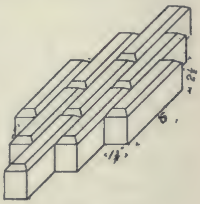


FIG. 79.

State the kind of brick, and, if possible, who from, the bond, the kind of pointing, whether struck as the work proceeds, or raked out and pointed afterwards, and whether pointed with putty or coloured mortar.

If any facing is gauged state where it is to be used, and how set. If any bricks are to be of special size it must be mentioned. Some of the facing bricks used in recent work have been only 2 in. thick. If a certain maker's best red facing bricks are described, the proved fact that they are supplied by such maker as best should not prevent their rejection for ordinary faults mentioned in the general description.

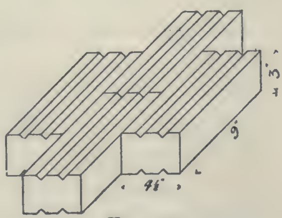


FIG. 80.

In the case of facing laid Flemish bond, stipulate that the perpends shall be kept.

Stipulate that all headers of facings shall be entire bricks and unbroken.

Stock Facings.—Picked stock facings are the commonest kind specified. The builder more often than not interprets the description in his own way, and has the better-looking bricks picked out of a cargo of ordinary building bricks after they are delivered on the site and uses them for facing.

As some brickmakers do not use the term "picked stocks" in their business, it is advisable, if good facing is required, to use some such clause as follows:—

"The bricks for stock brick facings to be of picked stocks, well burnt, sound, square, and uniform, and bright in colour. 'Picked' shall mean a description of brick selected at the brickmaker's yard, sold by him as picked stocks, and not merely selected from the bricks delivered. A sample load to be delivered and approved by the architect on the works before the remainder is supplied."

Other Facings.—In describing these bricks it is best to use the word "facing." For instance, if Lawrence's "best red bricks" are described, it may be argued that his "best red *facing* bricks" are not intended.

The best red facing bricks used in London are Lawrence's, Bracknell, T. L. B., Brown's, Braintree, Fareham, Hampshire, Hathern (Leicestershire), Cattybrook. They are suitable for use either internally or externally.

The best white bricks used in London are Ballingdon (Suffolk), Cambridge, Beart's, Arlesley.

Luton facing bricks are well adapted for additions to an old building; their sombre tone is less discordant with the old work.

Pointing.—The raking out and pointing with cement of work built in mortar is a good practice.

The fashion in pointing has changed in recent years. Tuck pointing is now rarely used by architects. Joints struck fair as the work proceeds has to a great extent superseded it, and the joint is generally weathered. Any defect in the shape or damage to the arrises of the bricks is made more conspicuous by this kind of pointing.

When joints are struck fair as the work proceeds, in default of an express stipulation for cleaning, the brickwork

is not left so clean as it would be if raked out and pointed after.

When pointing is specified in black or coloured mortar the work must be raked out and pointed, or the whole wall entirely built in such mortar.

Moulded Bricks.—The moulded or splayed bricks for plinths, string courses, cornices, architraves, &c., are most conveniently described by a number from a trade list, with the name of the manufacturer, if they are stock patterns, and say where they are to be used. State whether the courses shall be all headers or not, if on edge, if in cement.

Make clear what parts of the brick mouldings shall be rubbed and gauged, and whether of the facing bricks or rubbers.

Copings.—If coloured bricks describe them by a number from a trade list, and stipulate for solid blocks at the angles to match the remainder. If tile creasing is to be used in addition, describe it and the cement fillet thereon.

Ornamental Panels.—These, if intended to be of stock patterns, should be described by number from a trade list. State where they are to be fixed, and how set. Coloured mortar should be used. If rubbed and gauged, state it, and describe the bricks, and how set.

Gauged Work.—In describing rubbed and gauged work it is best to refer to a detail.

Arches in Facings.—Arches in picked stock facings are often built in rings, which require no cutting, except to skewbacks and extrados.

If not in rings they are usually axed.

In better facings they may be axed or gauged, and if the latter they would also be rubbed. Some architects stipulate that the kiln face should be untouched on the exposed faces of the arches.

If the arches are set in cement they would be either raked out and tuck pointed, or pointed to match the facing adjacent.

Glazed Brick Facing.—State the quality of the bricks and the name of the manufacturer, the colour of the bricks as described in the trade list, the mortar and cement, and the pointing.

The salient angles are usually bull-nosed.

Moulded cappings and skirtings are best described by a number from the trade list.

When a tile dado is described, with a tile skirting and capping, its height should be stated as ft. high in all.

If there is a wooden or cement skirting ordinary brickwork will be used behind it.

As cutting in glazed brickwork is very expensive, the arches should be segmental in rings. If not, the specification or drawings should clearly express the intention.

State what angles are "bull-nosed."

Glazed Hanging Tiles.—These will require a cement floated face $\frac{3}{4}$ in. thick. When on an old wall dubbing should be mentioned; the irregularity is often considerable:—

"Dub out the faces of old walls so as to produce a truly vertical face to receive the cement screed for the tile hanging."

The salient angles are sometimes made with cement, but generally a special angle tile is used.

Boundary Walls and Fences.—Boundary walls are usually built more cheaply than the other parts of the work in a contract. Except when they adjoin a public way concrete and damp-proof courses are often dispensed with. When the level varies, stepping the foundations at intervals will save expense, and in such case an average height from the bottom of the footings to the top of the wall is the clearest way to define the height.

State the thickness, the height, the size of the piers and their distance apart, whether the tops of piers are "tumbled in," or finished with courses of splayed bricks. These splayed bricks may be either stock patterns of coloured splayed bricks or blue Staffordshire.

Pointing with cement adds much to the durability of the work. The coping may be brick on edge in cement with an oversailing course on each side, blue Staffordshire brick, or half round bricks. The two latter are best described by number from a trade list.

Fences.—Iron fences may be simply iron hurdles. Bayliss, Jones & Bayliss's unclimbable iron fence is cheap and serviceable.

The separation of playgrounds or airing courts, as for a hospital, may be of wrought iron on a dwarf wall with a stone coping to which the railing is fixed. Describe the sizes of the parts. They vary in detail to any extent. The following is an instance of the kind:—

Separate the playgrounds where shown on plan by divisions as follows: "Build the dwarf walls to detail of 9 in. brickwork with two courses of footings on concrete 6 in. thick. Face with picked

stocks raked out at completion and pointed with a neatly struck and weathered joint in cement. Cope with 9 in. by 6 in. rubbed York coping, twice chamfered on upper edge, and in lengths of not less than 5 ft. The stones where the stays occur shall be 24 in. by 23 in. by 6 in. (Fig. 81). The whole to be bedded and jointed in cement, and each joint shall have a substantial double lead plug. The wall shall be 12 in. high above the level of paving, and 12 in. from the level of paving to the bottom of the footings. Supply in each gateway a 4 in. tooled York threshold 9 in. longer than the width of opening in one stone."

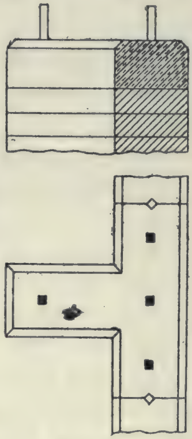


FIG. 81.

Faïence.—The supply and fixing of faïence is often a separate contract, the general contractor preparing the walls with cement-floated face to receive it, supplying water, attendance, and sometimes fixing.

As it is nearly all applied surface decoration, there is less reason than in the case of terra-cotta for its fixing by the general contractor, and it is, as a rule, better fixed by the manufacturer.

Describe the general thickness, the limit of size of the blocks, the kind and colour of the mortar, and whether the price includes modelling. Many of the tiles and mouldings will probably be of stock patterns.

If it is intended to supply the models of enriched work, insert a clause as follows:—

Models.—" The models for the enriched work to special design will be prepared for the manufacturer's use, but he shall do all packing and carriage of them from the building to his works. All the other models shall be made by the manufacturer."

Stock Patterns.—Such manufacturers of faïence as the Burmantoft Co. and Doulton (Lambeth) have a large variety of decorative material, and such articles may be described by reference to their catalogues.

Division of Work between Manufacturer and General Contractor.—Stipulations must be made that the general contractor shall do any necessary cutting away and making good of the structural work, the manufacturer supplying assistance in setting out. Supply sheds for its deposit, and case and otherwise protect it

from injury before and after fixing. Supply scaffolding and ladders, including their erection and removal. Supply any necessary water. The manufacturer should deliver, unload, and deposit his material, as he is least likely to damage it in the handling.

Workshops.—If the models for enriched work are to be supplied by the building owner, the general contractor should fit up a workshop for the modeller.

The rate and time of delivery should be prescribed.

Terra-Cotta.—A specific tint on the elevations or reference to a detail will assist the specification. Describe the general thickness, the limit of size of the blocks, the composition of the filling, whether filled in before or after fixing, the kind and colour of the mortar in which it is to be set, and whether the price includes modelling.

Often the modelling of the enriched work is a separate estimate, and a sum is provided. A clause should be inserted, if it is not intended that the terra-cotta manufacturer shall prepare all the models as follows:—

"The models for the enriched work will be prepared for the manufacturer's use, but he shall perform all packing and carriage of them from the building to his works. All the other models shall be made by the manufacturer."

If pieces of terra-cotta are adopted from stock patterns like those in the lists of the Burmantoft Co. (London), Doulton (Lambeth), or Edwards (Ruabon), they may be specified by number from the list.

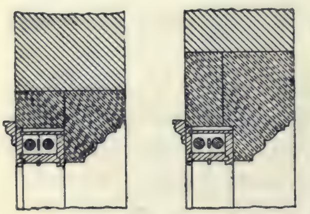


Fig. 82.

The extent of bonding should be defined, and in the case of window and door jambs the specification should clearly express the architect's intentions, and make clear whether any of these jambs shall extend to the inside of the frames. The best way is to have one half stop at the face of the frame, the other half at the back of the frame; the alternative is to let all stop against the outer face of the frame. In order to keep the pieces of terra-cotta jambs small they are often arranged with vertical joints. Show by detail how this shall be done. They may be divided in some such way as sketch (Fig. 82).

TERRA-COTTA.

Various Ways of Contracting for Terra-Cotta Work.—When there is but a small quantity in the building the general contractor will supply and fix it. Often it consists of such things as detached trusses, copings, finials, &c., which are selected from a manufacturer's list. Describe the quality, the filling, and the method of fixing, and what parts are in terra-cotta.

When it is in large quantity the manufacture and delivery is often made a separate contract, and the general contractor does the fixing.

In such separate contract stipulations must be made that the general contractor shall assist the manufacturer in setting out, numbering the pieces, and unpacking, shall case and protect and supply sheds for storage, that he shall fill the blocks with concrete and fix the terra-cotta.

The following is an ordinary description of terra-cotta and fixing only :—

Quality.—The terra-cotta shall be red, of the best quality, well burnt, and of even colour, and where hollow no part to be less than 2 in. thick. None of the surfaces shall be coloured by an applied wash; none of the original surfaces to be filed, rubbed, or chipped unless they are concealed, and these surfaces are to be as little interfered with as may be.

Filling.—The hollows of the terra-cotta shall be filled in solid with fine lime concrete, as before described, and the terra-cotta shall be previously soaked in water. No piece of terra-cotta shall, unless specially ordered, exceed 18 in. cube.

Setting.—The terra-cotta shall be set in fine mortar, neatly pointed as the work proceeds to match the facings, cleaned down at completion, and left perfect. It shall be thoroughly bonded with and course with the brickwork, and no joint shall exceed a quarter of an inch in thickness.

Arrises.—All the vertical and horizontal arrises to be left exactly true and regular.

Damage.—Any piece of terra-cotta which may be damaged for want of protection during the progress of the building shall be removed by the contractor and replaced by a perfect piece at the contractor's expense.

Clean up Reveals.—Carefully clean up and straighten the reveals and backs of terra-cotta where next to joinery.

The following work to be in terra-cotta as before described:—

Extent of Terra-Cotta.—The whole of the dressings of the windows of street front, the plinths, string courses, copings, finials, and quoins, the dressings of doorway, and the main cornice.

Supply 1 in. by 1 in. by 12 in. copper dowels to secure the finials.

Beds.—The beds of the terra-cotta may either be described or marked on the detail drawings in the manner recommended in section "Mason."

If the manufacture and supply is a separate contract, the following will describe the general contractor's work :—

Fixing only Terra-Cotta.

Supply of Terra-Cotta.—A tender has been accepted for the manufacture and supply of terra-cotta for these buildings, and a sum is provided for this work. See "Provisions."

General Contractor to assist Manufacturer.—"The manufacturer to receive any necessary assistance from the contractor in setting out the terra-cotta, and to supply the necessary workshops for the use of the modeller as may be directed by the architect."

Manufacturer to Deliver.—"The manufacturer will deliver the terra-cotta on the site, but the contractor to unpack, store, and protect it from injury under cover."

Contractor to Protect Work and make good Damage.—"The terra-cotta to be delivered on the site free from damage. Any piece of it which may be damaged for want of protection during the progress of the building shall be removed by the contractor and replaced by a perfect piece at the contractor's expense; or if the architect prefer it, the full cost of such replacement shall be deducted from the contract amount."

The contractor shall supply all casing and protection.

Limit of Time for Objection to Terra-Cotta.—"The contractor shall make any objection that he may wish to make to any portion of the terra-cotta within ten days of its delivery at the building."

Fixing and Filling.—"The terra-cotta shall be thoroughly bonded with, and course with, the brickwork, to include all cutting, fitting, and bonding of brickwork therewith, and no joint shall exceed ¼ in. in thickness. The jointing to be in accordance with the detail drawings to be supplied. None of the original surfaces to be filed, rubbed, or chipped unless they are to be concealed, and these surfaces shall be as little interfered with as may be. The chambers

of the terra-cotta to be filled in with fine concrete, mixed in the proportion of one part by measure of Portland cement, two of sand, and four of clean fine ballast. The stones to pass an inch ring."

"Each piece of terra-cotta to be thoroughly soaked with water before the filling in of the chambers, and the brickwork and terra-cotta in connection therewith to be thoroughly flushed in with mortar." Clean up and straighten grooves and terra-cotta against joinery.

Setting.—"The terra-cotta to be set in fine mortar, except as hereafter described, neatly pointed as the work proceeds, cleaned down at completion and left perfect." Describe any peculiarities of pointing.

Arrises to be True.—"All the vertical and horizontal arrises to be left exactly true and regular," and to this end the various pieces shall be laid out, assorted and aligned before setting.

Work set in Cement.—"Set in Portland cement the window sills, cornices, copings, and chimney caps."

Dowels.—"Secure the finials to the coping by 1 in. by 1 in. by 15 in. copper dowels."

Details.—The architect should complete the whole of his details before the contract is signed, otherwise *any* delay in their delivery to the manufacturer will almost certainly be used by him as an argument for extension of time and an excuse for delay in the delivery. These details should be of the ordinary kind, that is, to scale, not shrinkage details. The responsibility for shrinkage should rest with manufacturer, and the architect is much safer in rejecting an obligation which is not properly his. The apportionment of the time and rate of delivery of any material which is involved in a sub-contract of this kind must be carefully regulated, and if not in the way expressed in the section "Manufacture and delivery of Terra-cotta," in some such way as follows:—

Of a building for which the tender is £30,000 about one-third may be presumed to be finishings. This would leave £20,000 for the carcase, and it is during the time of the building of the carcase that the terra-cotta should be delivered. If eighteen months is the time allotted for the completion of the total contract, the carcase should be built in twelve months. Of this period a certain proportion should be allowed for fixing the last delivery. If we call this two months, we have ten months available for the manufacture and delivery of the terra-cotta. If the building is (for

example) divided for this purpose into three levels, and we adopt a regular proportion, we have three periods of $3\frac{1}{3}$ months each, which may be expressed thus:—

The whole of the terra-cotta up to the level of first floor shall be delivered before .

The whole of the terra-cotta between first and second floor shall be delivered before .

The whole of the terra-cotta above second floor shall be delivered before .

Large Chimney Shafts.—These are better described in separate sections comprising all trades. In the case of large and heavy shafts the foundations should be carefully considered. The bricks should be selected with judgment and in special cases tested. The brickwork should not be bonded with that of adjoining buildings, and they should not be built too quickly. About 6 ft. in height per day is a common stipulation. The joints should not be thick as unequal settlement is to be feared if there is too much mortar. In shafts of circular plan the bond is usually all headers, and these are sometimes radial bricks; in those of square or octagonal plan 4 courses of stretchers to one of headers is reasonable.

The ordinary precautions to be observed, the thicknesses of the brickwork and the general proportions of shafts of this kind are to be found in section 65 of the London Building Act, 1894.

Boiler Setting.—This work is best done by the engineer's bricklayers. The foundation is usually built by the general contractor for the building, who also supplies labourers to attend on the bricklayers, and the whole of the materials required for the setting. The fact that the engineer is made responsible for the successful working of the boilers and engines affords good reason for this practice. The time and materials would be charged as a day account. The work connected with the engineering is best described in a separate section of the specification.

Backing, &c., to Stone Walling.—When a rubble wall is built of stone throughout, and the stone is very hard, it is commonly the practice to build the internal and external angles inside the building of brickwork.

"Build the internal and external angles of the stone walling inside the building of brickwork in cement, a header and stretcher alternately."

In exposed situations rubble walls are liable to be wetted completely through. They are very often built with a cavity and a

half brick wall on the inside. Sometimes the cavity is filled in with mineral asphalte. In other cases the wall is lined with half brickwork with a course of headers, about every fifth course bonded to the stonework.

Rubble Walling.—When it is intended to build in a stone district the architect will find it advisable to see the local custom as to the treatment of the stone before he specifies it.

Material.—State from what quarry, how laid, heights of courses, and whether in mortar or cement; how many bond stones to each superficial yard of walling. Describe footings.

Sometimes an architect specifies: "Build where directed a piece of walling, as described, about 2 yards superficial and 18 in. thick, as a specimen to be approved before commencing the work, and pull it down and clear it away when (and not until) directed."

Facing.—State how dressed, how laid, and pointed.

Quoins.—State how treated.

Arches.—Describe arches.

Work in Cement.—State what parts are in cement.

MASON.

Local Stones.—Before specifying the masonry of a building the architect should find out whether the ordinary stone of the district is suited to his purpose. Stone inferior to that easily obtainable in the locality is often brought from a long distance.

Quarrying Stone long before Use.—Some specifications stipulate for the quarrying of the stone some months before it is used. If this is not the custom of the quarry the expense will be increased.

Stone from a Special Quarry.—The specification of stone from a particular quarry will sometimes induce the quarry owner to raise his price for the occasion. Considering this possibility it is a wise precaution to obtain from him, before the work is advertised, the price per foot cube at which he will supply the stone.

Materials.—Describe the quality of each kind of stone, the bed (if you desire any particular bed), and the quarry, how set, how finished, rubbed, dragged, scabbled, &c. Cleaned down at completion, and left perfect.

Backs of Stones.—Specifications often omit to say how the backs of stones are to be finished. If anything better than the quarry face is required it should be mentioned.

Quarry Working.—If quarry-worked stone is admissible, some such clause as the following may be used :—

"The quality of the stone shall be equal to a sample deposited with the architect. The stones shall be fitted together ready for setting, and shall include all necessary joggles and holes for dowels. The stone shall be marked with numbers for identification, shall be accompanied by a key plan, and shall be packed and delivered at the works at convenient times, all the stone required below level of ground floor before , all the stone required between ground and first floor before , &c." And if a separate contract is made with the stone merchant, say: "The stone merchant shall be responsible for, and make good, any damage in transit."

Quarry-worked stone is likely to be damaged on its way from the quarry, and for this reason stone worked at the building is to be preferred.

Beds of Stones.—If these are all to be described in the specification the process is a long one. A preferable plan is to refer to the details, upon which the beds of the stones should be marked. The average bed may be marked on where it is truly an average, as in ashlar, 7 in. average, &c.

Quoins and Jambs.—The quoins of Gothic buildings are sometimes described as *averaging* 12 in. by 9 in., or as the case may be. This is somewhat uncertain. Another way would be to decide upon the number of varieties, and describe thus: One third to be 12 in. by 7 in., one third 11 in. by 9 in., one third 15 in. by 7 in. The jambs to be alternately 4½ in. and 9 in. in length beyond the edge of the outer member of moulding or splay.

Marking Beds of Stones on the Details.—When quantities are prepared, it is a common and most convenient practice to supply the quantity surveyor with tracings of the stonework details upon which he marks the beds of the stones as he measures them. Let the dimension named be the original bed as the stone comes to the banker.

For alternative methods, see specimen clauses.

Injury.—Stipulate that any stone injured shall either be removed or its value deducted from the contract amount.

Dowels.—The kind, size, and position of dowels should be described. Slate dowels may be used for such things as mullions, transoms, and tracery, or in common work pebbles. Copper dowels for the fixing of crosses, finials, &c.

Cramps.—Iron cramps should not be used. Copper ones are better.

Metal Finials.—Finials of iron or copper are dangerous. They are apt to act as lightning conductors, and to split the stone to which they are attached.

Groove for Lead Lights.—Lead lights may be pointed with Mason's coarse putty or Portland cement.

Mortises for Iron.—Where cement or sulphur can be used lead should be avoided for the running of mortises which receive iron. When the lead is not exposed to the air it is not objectionable.

Some architects prescribe the size of mortises thus :—

"The mortises for the iron railings shall be cut before the stones are bedded, and shall be large enough to allow at least $\frac{3}{8}$ths in. of lead to be run in around the iron."

Groove for Flashings.—Where flashings adjoin a vertical face of stone grooves should be cut for them, and the flashings wedged and pointed in the usual way. Where a flashing is turned over the edge of a stone and lies on its upper face, a groove should be cut and the edge "burned in."

The following shows a method of describing dressings, and an alternative :—

CORSEHILL STONE.

Dressings.—"The following works to be in Corsehill stone from an approved quarry, finished with a finely rubbed face. The friezes over doorways, the main frieze, the coping, bonders, and springers of gables, principal front. (The pediments and cornices at top of these gables to be in moulded bricks.) The stone bands of upper storey of tower, the frieze at top of tower, the rims of clock openings with dovetailed mortises and gutta-percha plugs, six to each opening for attachment of clock faces, the key-stones to square-headed recesses for clock."

The beds of stones are marked on details Nos. 31, 32, 33, 34, and 36. They are the dimensions of the stone as it comes to the banker.

Or,

CORSEHILL STONE.

"The following works to be in Corsehill stone from an approved quarry, and finished with a finely-rubbed face. Set in fine mortar, cleaned down at completion, and left perfect. The beds described are those of the stones as they

come to the banker, the joints to have double arris joggles run with cement.

"The friezes over doorway 9 in. on bed.

"The main frieze 9 in. on bed returned on north wall of central block, the distance shown on south wall as far as the projection of chimney back.

"The coping, bonders, and springers of gables principal front. (The pediments and cornices at the tops of these gables to be in moulded bricks.)

"The stone bands of upper storey of tower average 7 in. on bed.

"The frieze at top of tower to be 9 in. on bed, except at angles, where it shall be 20 in. on bed.

"The rims of clock openings to be 9 in. on bed, with dovetailed mortises and guttapercha plugs, six to each opening for attachment of clock faces.

"The keystones to square-headed recesses for clock 9 in. on bed, &c."

Steps and Thresholds.—Define how much the lengths shall exceed the widths of the openings.

Staircases.—How far steps and landings shall be pinned into walls, any other general stipulations which apply to the whole of the masonry. Describe bonding, dowels, cramps, the finish of backs of stones.

Follow with stones of each kind, beginning with the least expensive, in something like the order for a bill of quantities.

Yorkshire Stone.

Quality.—Yorkshire stone varies very much in hardness. Where durability is important, the quarry may be mentioned thus:—

"The hard York stone where described as rubbed to be of the finest selected quality from the Spinkwell quarries, near Bradford."

"The pavings shall be of the Silex brand."

Long Lengths.—When any stones in curbs, copings, &c., are required in long lengths, state the minimum that will be accepted.

When any stones in pavings are required of larger size than usual, state the minimum or exact superficial area of each stone.

Finish.—State the finish as rough, rubbed (called polished in the north), tooled, self-faced.

Templates.—State the size and position of each template.

The list may be shortened by settling a size for templates to all bearers not exceeding a certain size, when they may be described thus :—

"9 in. by 9 in. by 3 in. to all bearers not exceeding 24 in. of sectional area."

"14 in. by 9 in. by 3 in. to all bearers exceeding 24 in. and not exceeding 48 in. of sectional area," &c.

Rough Corbelling and Cover Stones.—State thickness, whether set in mortar or cement, and the width of cover stones.

Stone cores are necessary for cement cornices, state the thickness, and how much they tail into the walls.

Thresholds.—State thickness and width, and how finished.

Sills.—State thickness and width, and how finished, and how much longer than openings.

Steps.—State thickness and width.

Copings.—State size and finish. If Apex stones, Kneelers or bonders, are required, describe them.

Hearths.—State thickness, width, howmuch longer than width of opening, how finished.

Staircases.—State size of steps, and the sort, as solid, spandrel, treads, and risers; thickness of landings, how finished and how jointed.

Pavings.—State thickness and finish, whether parallel courses; state superficial content of each stone if large stones are required, how set.

Bases for Columns, &c.—State width, length, and thickness, how finished, if sunk for iron bases or mortised for stubs.

Chimneypieces.—State size of jambs, mantels, and shelves, and how finished and fixed. For marble chimneypieces a sum is usually provided.

Follow in the same order with the various kinds of stone, those of greatest value last.

Carving.—This is in many cases a provision. The architect selects a carver, explains what he requires, and its extent and the amount named by the carver is included in the estimate as a provisional sum. Often a sum is provided such as the architect deems sufficient, and the arrangement is made with the carver, when the building is ready for his work. A more definite preliminary agreement than common may be made by stipulating that the work shall be equal in finish and amount of detail to some previous known work of the carver.

Granite.—State the kind, the quality, and finish, and define the beds, as suggested for freestone dressings.

Granite work is nearly always a separate contract.

The architect may be reminded that when in a granite district he should examine the local production before he decides to use Aberdeen or other Scotch granite.

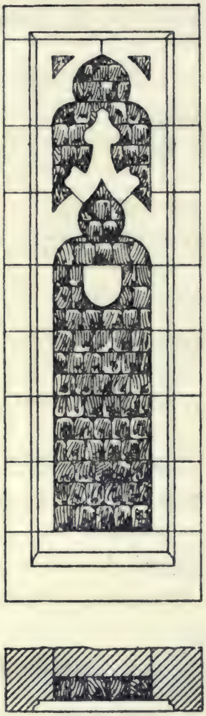


Fig. 83.

Marble.—It may be mentioned that some of the more expensive and beautiful marbles cannot be obtained free from cracks and faults, and must be stopped, that some of the coloured marbles and serpentines rapidly lose their beauty, and some their colour almost entirely, if used out of doors. In using marble for steps it will be necessary to decide whether treads and risers or solid steps will be required, the latter or rather thick treads must be used if there is much traffic. Wall lining should be cramped with copper cramps to the brickwork, and sometimes as an additional precaution, small copper dowels may be used in the beds.

Flint-work.—Flints are sometimes used for facing. They may be used either in their natural condition or knapped, that is, broken, and the broken face exposed on the face of the wall. They must be set in cement, with a brick backing also in cement. The quoins, the dressings and arches of windows must be in brick, and string courses of bricks two or three courses high and about 5 ft. apart must be used on the face of the wall.

In some Tudor work it was customary to fill in panels of freestone with squared and dressed flints, as Fig. 83. They are but rarely used in that way now.

Artificial Stone.

This is frequently used instead of natural stone, and is supplied by various makers.

Pavings.—Pavings are supplied by such makers as Stewart, the Victoria Stone Company, the Westminster Paving Company,

Wilkinson of Newcastle, Ward, &c. If it is likely to require removal it should be cast in slabs and laid like York paving; if not, it may be made *in situ*, and is all the better for its freedom from joints.

Specify the name of the selected maker, and state its thickness and whether laid to falls or not.

Stairs.—Steps and landings of artificial stone are cheaper than stone ones if they are of simple and recurring shape, but when a staircase comprises a number of winders of various shapes, it will often cost as much as a stone one.

Steps.—"The steps to be of the section shown on detailed drawing, and shall be made at least a month before fixing. Each step shall have embedded therein near its lower face two rolled iron bars ½ in. square, the whole length of the step and roughly turned (cold) at each end."

Wooden Treads.—As this material is slippery, the treads are sometimes covered with teak treads, let into the treads and secured by screws, described thus—

"Let into each tread of the staircase for its whole length and width 1¼ in. teak wrought tread with the arris slightly rounded, fixed with 2 in. brass screws, six to each tread, the heads let in flush and screwed to strong brass nuts embedded in the step."

Dressings.—Artificial stone for dressings is supplied by the Victoria Stone Company, Lascelles, and others; it may be either a separate contract or may be included in the general estimate, If the architect is indifferent as to the maker he may offer the builder the option of employing one of several makers whose names are specified, or he may select a particular maker. In any case the use of a tint for the material on the elevations will assist the specification. The alternative to the tint is the specific mention of all the parts of the building which are intended to be of the material.

Form for Separate Contract.—If the stone is a separate contract, the stipulations as to delivery, payment, &c., would take a similar form to that suggested for terra-cotta. Ordinarily it may be described in some such way as follows:—

Quality and Maker.—"The artificial stone for dressings is tinted red on the north, east and west elevations; it shall be supplied by Messrs. Wilkinson & Co., the Victoria Stone Company, the Patent Paving Construction Company, or other approved specialist in artificial stone, and shall be ordered within a fortnight of the

signing of the contract, so that the stone may be hardened for use."

Moulds.—"All patterns and moulds to be provided as required."

Setting.—"The whole of this work shall be set and closely jointed in Portland cement; shall be protected, kept clean, and free from smearing and discolorations, cleaned down at completion, pointed to match the facings adjacent, and left perfect."

Colour and Samples.—"It shall be red, of a tint approved by the architect, and of the same colour throughout its whole substance, and the manufacturer shall submit samples for approval."

Beds.—"The beds of these dressings shall be as figured on the detailed drawings."

Iron Rods.—"The transomes, heads and mullions shall each have ½ in. diameter wrought-iron rod embedded therein."

Dowels.—"Each joint of transomes and mullions shall have 1 in. by 1 in. by 4 in. slate dowel. Form and clean up all grooves and rebates."

SLATER.

Pitch of Roofs.—Slating may be laid on roofs of very low pitch but it is not necessary to describe the pitch in the specification as some do, the drawings should show it. When tiles are used the pitch should be increased. The lap should not be less than 2½ in., but 3 in. is better. Either the lap or the gauge should be specified.

Spaced Slating.—If spaced slating is used it is best to state the proportion the slates shall bear to slating laid in continuous courses, thus—

"Cover the out-houses with spaced slating to a 2½ in. lap, with two composition nails to each slate. The number of slates used per square shall be equal to two-thirds of the number required for a square of continuous slating of the same laps"; or the distance apart of the slates may be stated. Although the regulation sizes of Welsh slates are well known, it is better to state the size. Countesses are made 20 in. by 10 in. and 16 in. by 10 in. The custom of specifying the 20 in. by 10 in. prevails and the 16 in. by 10 in. are cheaper.

Quality of Slates.—Most of the slates of the common designations are supplied of a first and second quality, and the very large ones, as Queens and rags, are sold by the ton.

Westmoreland slates are occasionally used in London. They are sold by the ton; they are of promiscuous sizes, which the slater sorts when laying, using the largest at the eaves and the smallest at the ridge; the gauge and width of the slates consequently gradually diminishing from the eaves upwards.

Stone Slates.—Stone slates are commonly used in various parts of the country. Some of the oolitic limestones are stratified in very thin layers, and are used under this name. They are found, among other places, in Northamptonshire, Staffordshire, Oxfordshire, Gloucestershire, and Sussex.

Both Westmorland slates and stone slates require longer nails than Welsh slates, because of their thickness, and for them battens are nearly always used as well as the boarding. Stone slates are usually bedded in mortar, and in much exposed situations in cement.

Verges.—The slating of verges should be bedded and pointed in cement. Sometimes the faces and soffits of the verges are rendered and floated in cement, or a slate soffit and hollow fillet is formed thereon.

Ridges.—Ridges may be of stone, tile, slate, or lead. On stone slating soakers are preferable to stepped flashing, because of the roughness of the slates.

Thicker Boarding sometimes Necessary.—When slating is nailed directly to roof boarding, which is seen inside the building, 1 in. boarding will usually show the points of the nails, and thicker boards should be used.

Ladder Hooks.—Iron hooks are sometimes used for the support of ladders for the repair of roofs, specified thus :—

"Fix where directed fifty ½ in. by ¾ in. galvanized ladder hooks, 18 in. girth, each screwed to the back of a rafter with three 2 in. stoutest screws."

Slates.—State description of slates, and size as well as designation; if from a particular quarry, the name of quarry. The lap, the number of nails to each slate, their length, kind, and if copper their weight per thousand. Describe as all cut close to hips, ridges, and vertical faces, and eaves laid double.

Verges.—State how treated.

Torching.—If torched, describe how done, and with what mortar, lime and hair, or cement.

Hips.—Describe treatment, if screwed with copper screws, if bedded in cement.

Ridges.—If of slate, size of roll and wings, and state how fixed. If patent, give name of patentee. If of tile, select from a manufacturer's trade list, stating name, number, and how set.

Leave Perfect.—Finish with a clause, "Clean out gutters, and leave all roofs clean, perfect, and weather-proof at completion."

SLATE MASON.

Slabs.—Slate slabs vary considerably in their quality. Valentia is the best next the Bangor. Self-faced slabs are the commonest, and unfit for good work, and as these are split, *sawn* slabs should always be specified.

The surfaces may be planed, planed and rubbed, planed, rubbed, and sanded, and in addition to this they may be oiled.

Cisterns.—Cisterns may be specified of certain clear dimensions, or they may be specified to hold a certain number of gallons. In the latter case a stock size would be adopted, and the cost would be less. The stock sizes are made of slate of the same thickness throughout. The use of slate cisterns has been almost entirely superseded by galvanized iron. Slate cisterns may be specified in some such way as follows:—

"Supply in cistern room a slate cistern 5 ft. 6 in. by 3 ft. 6 in. by 3 ft., all in clear of 1 in. sides and 1¼ in. bottom of best Bangor sawn slate, all grooved together and secured by four ⅝ in. diameter wrought-iron galvanized bolts, with heads, nuts, and washers, and jointed in oil mastic cement. Cut all holes for supplies and wastes, and leave perfect and waterproof."

Shelves.—Shelves may be 1 in. or 1¼ in. thick, and may be sawn both sides, sawn and rubbed one or both sides, sawn, rubbed, and sanded one or both sides. Their widths may be specified, or they may be described as of the width shown on the drawings.

The joints should be splayed and jointed with red lead cement. They should be in single lengths wherever possible. Where a length is jointed a bracket will be necessary beneath the joint. The brackets may be cast-iron, slate, or a length of T iron. The edges of the shelves where next the walls should be pinned in.

Describe the slate, its thickness, its finish as sawn, rubbed, sanded, how far pinned into wall, how jointed, how secured to cantilevers.

Urinals.—Backs, ends, and divisions to urinals should each be in one slab. The backs may be screwed with copper screws with countersunk heads to oak plugs in the brickwork, and bedded

against the wall with Portland cement, the jointing to be in red lead cement. The divisions may be attached to the backs by pairs of $\frac{3}{8}$ in. brass or gun-metal angle plates, 3 in. by 3 in. by 2 in., each pair secured by two $\frac{1}{2}$ in. gun-metal bolts with heads and nuts, and four $1\frac{1}{4}$ in. gun-metal screws, the heads countersunk and screwed into lead plugs in the slate, two pairs of angle plates to each division.

Each of the ends may be secured to the backs in a similar manner by two angle plates with four screws to each.

Slate backs have been superseded in the public urinals by enamelled terra-cotta or fire-clay backs.

Urinal Backs, Ends, and Divisions.—Describe thickness, how finished, how connected, how secured to walls. Describe the metal work, as angle plates, bolts, &c., here.

Urinal Channels.—Channels of rubbed slate are sometimes used for urinals, described thus:—

"Put rubbed slate channel the whole length of the urinal range 9 in. by 4 in., with channel 3 in. wide, sunk to fall towards one end. Stop the sinking at both ends, form a rebated perforation at one end, and fit with Bolding's (283) 4 in. brass urinal grate bedded in cement."

Sometimes a few courses of white glazed bricks are laid in front of the channel as paving, or a slab of slate of similar width.

Enamelled Slate.—Slate is enamelled in various plain tints and in imitation of various marbles. Enamelling is often very badly done. The architect should choose the firm who shall do the work, and avoid such as has no reputation to lose.

Cantilevers.—Describe how finished, thickness, width and length, how shaped, how far pinned into walls.

TILER.

Local Tiles.—Before specifying tiling inquiry should be made as to the tiles obtainable in the neighbourhood of the proposed building. A large proportion of the roofing tiles that are made are of common quality.

Tiles most frequently Used.—The greater part of the roofing tiles used in London are brought from Reading, Maidenhead, Bracknell, Broseley or Ruabon.

Tiles may have Nibs or Nails, or Both.—Tiles may have nibs, and be hung on the laths without nails, or have nibs and nails, or nails only without nibs.

Gauge.—The ordinary gauge 3 in. or $3\frac{1}{2}$ in., sometimes 4 in.

Pitch.—The pitch for tile roofs should be greater than that of slate roofs.

Tile and Half.—In order to avoid the use of small pieces of tile "tile and half" should be used at hips, valleys, and verges. State where tile and half to be used.

Verges.—The tiling of the verges should be bedded and pointed in cement. Sometimes the faces and soffits of the verges are rendered and floated in cement, with a tile soffit and cement hollow on the face. Describe their treatment.

Hips and Valleys.—Purpose-made tile hips and valleys are most conveniently used where all the roofs are of the same pitch, or where the difference is slight, otherwise the appearance is awkward. When various pitches intersect closely cut and mitred hips with lead soakers beneath, and closely cut and mitred valleys with a lead valley gutter beneath are to be preferred. If purpose-made hip and valley tiles, describe them.

Ridges and Hip Knobs.—Ridges and hip knobs should be of tile described by a number from a trade list, or hip knobs may be of wood covered with lead. State how bedded.

Soakers preferable to Stepped Flashing.—On tile roofs soakers or a secret gutter are preferable to stepped flashing. The work looks neater, and the lead of a stepped flashing cannot be satisfactorily dressed over the tiles.

Ornamental Tiles.—If a part of the tiling is of ornamental tiles the proportion may be described as "one half of the tiling to be of ornamental tiles in bands," or "the tiling of roofs to be in alternate bands of six courses plain and three courses ornamental."

Staining Tiles.—Sometimes when tiles are very red they are stained, and thus described "the tiles to be stained to a tint approved by the architect."

Vertical Tiling.—Vertical tiling on walls is often nailed with tenter hooks to battens plugged to the wall, sometimes fixed without battens and nailed into the joints of the brickwork, in which case the bricks are often laid on edge. When on boarding as to dormer cheeks, it is best screwed thereto with copper screws. The eaves may be set out with an eaves fillet or sprockets plugged to the wall.

Tiling.—State description of tiles, the gauge, whether with nibs or pins, and describe the pins, if laid dry, if bedded, and

whether bedded in mortar or cement; the laths. Note that it is customary to describe tile-laths with the tiles, in which respect the method is different to that observed with slating, the battens to which are described in "Carpenter."

Leave Perfect.—Clause as in "Slater."

Shingles.

The ordinary oak shingles are rent about 12 in. by 4 in., are laid to an ordinary tile gauge, and are nailed with copper nails. If an imitation of the effect of shingles with pieces of wrought-oak is intended, the size and thickness of the shingles should be stated. The hips may be either close cut and mitred, in which case soakers will be required, or oak hip pieces out of the solid may be used to course and bond with the rest.

CARPENTER.

Sawn Timber.—The practice of specifying sawn timber for the carcasing of buildings is still frequent. A clause in common use is as follows:—

"The fir timber is to be of the best description, from Memel Riga, or Dantzic, sawn die square, free from sap, shakes, large, loose, or dead knots, and all other defects, and sawn into scantlings immediately after the signature of the contract."

Or,

For work inferior to the last: "The timber shall be Memel or Dantzic of good middling quality, or where under 11″ wide and 4″ thick from sawn scantlings of Shipper's fourth quality Swedish hand or Shipper's third quality Russian hand."

Substitution of Deals for Baulk Timber.—In the majority of cases this stipulation is met by the use of planks, deals, or battens of poor quality, the use of which is tolerated, and their defects disregarded.

The architect should decide whether he wants wood sawn uniformly out of baulks or out of sizes as imported, as deals, battens, or planks. He will then specify his timber by the recognized trade designation, as:—

Memel *Crown*:—Best middling, second middling, or common middling.

Dantzic, Riga, Stettin:—Best middling, second middling, or common middling.

The imports from Riga are so small in quantity as to be hardly worth mention in a specification.

Second middling is generally very good serviceable timber. More definite stipulations are required as to knots; the limitation of their size would be a step in advance. Some architects use a clause as follows:—

Knots.—"Timber with knots over 1½ in. in diameter shall be rejected."

Oregon or Pitch-pine sometimes Preferable.—When timbers of unusually long lengths are required Oregon pine or pitch-pine is used.

Imported Sizes.—The difficulty of obtaining *dry* baulk timber is one of the reasons why deals and battens are often preferred for the carcasing of a building, and, as a rule, better seasoned material is obtained in this form. They may be designated by a shipping mark or the name of a manufacturer. The imported sizes should be used where possible, or parts of them, thus: 9 in. by 3 in. will cut two 4½ in. by 3 in., 11 in. by 3 in. two 5½ by 3 in., &c.

Swedish deals are best for this work.

Four in. deals should be avoided, as they are often cut from the centre of the trees.

The foregoing suggestions may be thus expressed:—

"The whole of the timber shall be perfectly sound and well seasoned, perfectly free from sap wood, from knots more than 1½ in. in diameter, loose or decayed knots, wany edges, and all other defects, and sawn die-square."

"The timbers which cannot be cut out of deals, battens, or other imported sizes shall be of best middling Dantzic."

"The timbers which can be cut out of imported sizes shall be shippers, thirds, Swedish, deals, H. A. B., or other brand approved, and of equal quality."

Principles of Deal Sorting.—Although descriptions of material have been avoided in this book as much as possible, it may assist the architect to define quality of Baltic deals to append a synopsis of the principles which regulate the sorting of deals in two of the leading districts of Sweden (Gefle and Sundswall).

An extract from the wood industries of Sweden in the annual of the "Timber Trades Journal," published by Messrs. Rider, Bartholomew Close, London, E.C., through whose kind permission the following is reprinted:—

A redwood deal 3 in. by 9 in., and 18 ft. long, is taken as the standard in both these districts, and that the defects appertaining to any particular piece are greater or less than in the 18 ft. 3 in. by 9 in. in same proportion as the piece being handled is of larger or smaller size than the standard. We shall treat Gefle first.

Gefle—English Mixed or French Firsts.

The wood must be perfectly sound, and the deal full sized.

Shakes.—Only so-called drying or sun shakes are allowed, and these must only be of a shallow description, say about $\frac{1}{4}$th of the thickness of the deal and 2 or 3 ft. long.

Knots.—Four or five knots only, of the diameter of $\frac{5}{8}$ths of an inch, are allowable, and these knots must be of about the same colour and appearance as the deal itself, so that they blend well together, and are not situated at the edges of the deal.

Wane.—Wane on a few of the deals of $\frac{5}{8}$ths of an inch on one flat side and one edge of the deal is passed, but such wane must not extend for more than 18 in. in length.

If the wane on the flat is less than $\frac{5}{8}$ths of an inch broad, then the length can be correspondingly increased.

Bluewood is *not* allowed, and the ends and edges of the deal must be free from blemish.

Gefle—English Thirds or French Seconds.

Wood sound and dimension full.

Shakes.—If not more than about 3 ft. long, and only extending through half the deal, are allowable; but at the end must be less than half the thickness of the deal.

Knots.—Three or four knots of not more than $1\frac{1}{8}$ in. in diameter may be found on the flat, provided same are sound and fast grown to the wood, and are of a similar colour to the deal. Flat knots at the edge must be small and fast, and not extend above $\frac{1}{3}$rd the thickness of the deal, otherwise not allowed.

Wane.—Wane not exceeding 1 in. broad may be found on one flat and one edge of the deal only, but same must not be more than 3 ft. long. If less than this breadth, then the length of the wane can be increased.

Bluewood.—Caused merely by insufficient ventilation in the piles, is allowed to a slight extent, provided same does not affect

more than one flat and one edge, and that the deal is otherwise sound. Blue sap not allowed.

Gum-knots.—So called "gum-knots" not more than 1 in. in diameter are passed, if not more than three or four in number. The slight alteration of colour that precedes dry-rot is also allowable in these gum-knots.

Gefle—English Fourths or French Thirds.

Shakes.—This quality may have several shakes that go nearly through the deal, but not in such manner that same run for such a length that the wood loses its power to withstand a crushing strain. In other words, there must be an interval between the shakes. So-called cross or edge shakes may also be found to a slight extent if same are not of such description that the deal thereby is sensibly weakened.

Knots.—Knots may be found both on the flat and edge, if same are sound; but black or unsound knots of more than about $\frac{3}{4}$ in. in diameter and four in number must not exist.

Wane.—Wane of not exceeding $1\frac{1}{4}$ in. broad on the flat, and not more than 5 ft. long, is passed. The length of the wane may be increased if the breadth is less than that named.

Dry-rot.—Small streaks, if of a hard description, may exist, but same must be in the first stage of the disease, or have the burnt appearance designated "rodved" in Sweden.

Very small wormmarks may be found, but the deal must be full measure.

Bluewood.—Bluewood may exist on a small portion of the deal, especially if same merely affects the sappy edges, and is clearly the result of exposure to the atmosphere.

Gefle—English Fifths or French Fourths.

This, the lowest of the regular qualities, may have all the blemishes referred to under the heading of English fourths, *but much more developed.*

Shakes of all descriptions may exist provided they do not reach the whole length of the deal, so as to render the same liable to split up.

Knots of all kinds, and on both the flat and the edges, are allowed.

Wane on both sides is likewise passed, and a very slight under measure is tolerated.

Dry-rot is allowed in this quality, provided same does not reach both sides of the deal, or is visible to the greater part of its length.

In comparison we shall now give the usual sorting rule at Sundswall, but wish here to remark that same is not strictly followed by all the exporters, especially as regards the amount of wane which a 3 in. by 9 in. deal can have.

Sundswall—English Mixed or French Firsts.

The wood must be quite sound and full-sized.

Shakes.—Only drying shakes, or so-called sun shakes, which must not extend through more than about $\frac{1}{4}$th of the thickness of the deal, and to only a small portion of the length, are admitted.

Knots.—These must be sound, and not above $\frac{3}{4}$ in. in diameter, and four or five in number. Edge knots are rejected as well as wormholes, and black knots, unless the latter are very small.

Wane.—Not allowed except on a few of the deals, and then same must only measure about $\frac{1}{2}$ in. in breadth, and reach a short distance on one flat and edge of the deal.

Bluewood is not admissible, with the exception of a light blue tint that has evidently arisen from want of circulation in the pile, and even in such case it must only be shown on one flat, and only extend for a short distance along the deal.

Sundswall—English Thirds or French Fourths.

Wood sound, and the deal full measure.

Shakes.—A few of these are passed (both heart and other shakes), but same must not reach to more than about $\frac{1}{3}$rd of the length of the deal.

Knots.—Sound knots, if not larger than $1\frac{1}{2}$ in. in diameter, are passed; flat surface and edge knots are not allowed.

Wane.—A maximum of 1 in. wane on one flat and edge of the deal is passed. If, however, same is found on both edges of the same flat, then it must not exceed $\frac{1}{2}$ in. in breadth on each edge.

Bluewood, arising from the heating of the stacks, is admitted, but not if the fibre of the sapwood is blue, or if the defect has reached more than a small portion of the length of the piece.

Sundswall—English Fourths or French Thirds.

Wood free from rot, but so called "burntwood," or the symptoms of the commencement of dry-rot, if only shown on a small portion of the deal, are passed. Wormholes, and a slight degree of under measure, if these defects exist on otherwise sound deals, are allowed.

Shakes.—Shakes of all kinds are admissible provided same are not "through" the deal, and reach the greater portion of the length.

Knots.—Knots both on the flats and the edges may be found, but large "black" or "rot" knots are rejected.

Wane.—A broader wane than for the preceding quality is allowable, and same may reach half the length of the deal.

Bluewood and Blue-sap are passed if clearly the result of exposure to the atmosphere, and sparsely distributed over the deal.

Sundswall—English Fifths or French Fourths.

In this quality rot of all kinds, if in the first stage, may exist sparsely, provided same is firm, and has not reached the whole thickness of the wood, or stretches to a large portion of the length of the piece.

Shakes.—Shakes of all descriptions can exist provided these are not "through."

Knots.—Knots of all kinds are admissible, both on the flat and edges.

Wane.—Wane on all sides may be found, likewise a slight degree of under measure on a portion of the parcel.

It is of course understood that only a small portion of the blemishes described under the head of each quality can be found on one and the same piece. It is here that the sorter's art can alone decide what can pass muster.

The above are the principal rules that guide the sorter in the two districts referred to, but it must be understood, as before remarked, that as these rules are made for a 3 in. by 9 in. deal they are modified, in proportion as this standard is less or greater than the size being dealt with. For instance, the size of the knots must naturally be diminished as the thickness of the wood decreases, and a wane on an inch board is considered of less consequence than knots. The quality or "nature" of

the wood is also a deciding factor in the sorting, and the eye and experience of a trained sorter can alone determine whether a particular piece is likely to improve, or otherwise, by confinement in a ship's hold. The degree of dryness of the wood is also an important point as well as the local requirements or prejudices of a particular market.

American Deals.—Spruce and pine deals from New Brunswick, Nova Scotia, and Canada are brought to Liverpool and other ports on the west coast, and to Ireland, they to some extent, supersede the use of Baltic wood for carcasing in the adjacent districts.

Oregon Pine.—If Oregon pine be used it may be thus described: "The timber throughout shall be Oregon pine of quality known as selected, well seasoned, free from sap shakes, dead knots, and all other defects, and sawn die square," and no outside slabs shall be used. Three qualities are imported—"clear," "selected," and "merchantable."

Pitch-pine.—If pitch-pine be used it may be thus described: "The timber throughout shall be pitch-pine of 'prime quality,' sawn die square, free from sap shakes, dead knots, and all other defects, and no outside slabs shall be used."

Pitch-pine timber is imported under three designations—"selected," "prime," "merchantable."

Distinction of Carpentry and Joinery.—Some architects write "Carpenter" and "Joiner" together, but they are best separated. As a general distinction, carpentry is rough timber brought to the works, and worked and put together at the building. Joinery is usually prepared at the builder's yard, and is afterwards brought to the building and fitted and fixed.

Materials.—Describe the various woods, and decide whether to have timber or deals for the carcasing.

There is always a certain proportion of wood in a building which can only be got out of baulk timber. But there is also a large part for which imported sizes in deals and battens are well adapted. The range of ready-sawn scantlings of late years has been greatly increased, and they are for many reasons to be preferred to timber sawn from the log in England.

If these are adopted the writer should specify the imported sizes or any easy conversion of them. The most frequent sizes are 7 in. by 2½ in., 9 in. by 3 in., 11 in. by 3 in.; but there are also obtainable 2 in. by 4 in., 2 in. by 4½ in., 2 in. by 5 in., 2 in.

by $5\frac{1}{2}$ in., 2 in. by 6 in., 2 in. by 7 in., 2 in. by 8 in., 2 in. by 9 in., 2 in. by 10 in., 2 in. by 11 in., $2\frac{1}{2}$ in. by $5\frac{1}{2}$ in., $2\frac{1}{2}$ in. by 6 in., $2\frac{1}{2}$ in. by $6\frac{1}{2}$ in., $2\frac{1}{2}$ in. by 7 in., $2\frac{1}{2}$ in. by 8 in., $2\frac{1}{2}$ in. by 9 in., 3 in. by 7 in., 3 in. by 8 in., 3 in. by 9 in., 3 in. by 10 in., 3 in. by 11 in., 3 in. by 12 in., 4 in. by 7 in., 4 in. by 9 in., 4 in. by 10 in., 4 in. by 11 in., 4 in. by 12 in.

Properly to specify the timbering of a building requires a knowledge of the wood market which is somewhat rare with architects.

Ironwork.—Describe all ironwork with the timbering which it secures, and in the case of a series of bolts at equal intervals, state their distance apart.

Follow with the general stipulations which apply to the *whole* work, some of which follow:—

Distance apart of Timbers.—Distance apart of joists, rafters, and quarters. Do not describe caulking (or cogging) unless you require it.

Trimmers.—How much thicker than the common timbers. Some specifications simply stipulate that all trimmers shall be 1 in. thicker than the common timbers; others, "all trimmers and trimming joists shall be increased by $\frac{1}{8}$ in. in thickness beyond that of the ordinary timbers for every joist framed into the trimmer.

Lintels.—Describe how far they shall bear at each end on the internal jambs, and their depth. It is convenient to say that they shall be "1 in. in depth for every foot of span, but not less than 3 in. deep."

Wood Bricks.—Describe what joinery will require for its attachment, as pads, wood bricks, concrete fixing blocks. State if creosoted, and their distance apart.

Centering, &c.—Describe centering, bracketing, cradling, filleting soffits of trimmers.

Dowels.—Describe dowels for frames.

Finished Sizes.—In the absence of a clause to the contrary, sizes are assumed to be less than those specified by the thickness of a saw cut each way. If finished sizes are desired, a clause should appear: "The whole of the sizes named in the specification or figured on the drawings to be the sizes when finished and fixed."

To provide against the excessive waste which sometimes occurs in the conversion of timber, a clause like the following

is sometimes used when there is no stipulation for finished sizes:—

"The whole of the timbers sawn out of baulk shall measure the sizes specified when fixed subject to an allowance of not more than $\frac{1}{8}$ in. for each saw cut, but those converted from deals or battens shall hold the full specified sizes when fixed."

Deals and battens always measure their reputed sizes, as 9 in. by 3 in., 7 in. by $2\frac{1}{2}$ in., &c.; and this is the case with all the great variety of imported scantlings.

Scarfings of Timbers.—State the extent of lap required in scarfed timbers, and if bolted together describe the number and size of bolts to each.

Roofs.—Begin with a description of the principal trusses and their position, stating scantlings of all the timbers, and describing the ironwork with them.

Then the exceptional roofs thus, one at a time: "Construct the roof over porch of plates $4\frac{1}{2}$ in. by 3 in.; purlins, 8 in. by 5 in.; ridge, 9 in. by $1\frac{1}{2}$ in.; rafters and collars, $4\frac{1}{2}$ in. by $2\frac{1}{4}$ in. Construct the roof over kitchen of," &c.

It will be possible when exceptions are disposed of to describe the remainder together, thus: "The remainder of the roof to have plates $4\frac{1}{2}$ in. by 3 in.; purlins, 10 in. by 6 in.; ridge, 11 in. by 2 in.; rafters, $4\frac{1}{2}$ in. by $2\frac{1}{4}$ in."

Sometimes it is convenient to tabulate the scantlings of roofs thus:—

MAIN ROOF.

	in.		in.
Plates and pole-plates	$4\frac{1}{2}$	by	3
Purlins	8	,,	5
Ridge and hips	9	,,	$1\frac{1}{2}$
Valleys	9	,,	2
Rafters	$4\frac{1}{2}$	,,	$2\frac{1}{4}$

ROOF OVER BEDROOMS 4 AND 5.

Plates	$4\frac{1}{2}$	by	3
Rafters and collars pinned with oak pins	$5\frac{1}{2}$	,,	$2\frac{1}{2}$
Purlins	6	,,	4

&c., &c.

Boarding to Roofs.—Describe thickness, and in what widths, whether laid diagonally, if wrought, V-jointed, matched, and beaded. If boarding to roofs is wrought it must be thick enough

to avoid showing the points of the nails inside. The use of slating battens or tile laths will prevent this.

Felt.—Kind, and how nailed.

Slating Battens.—State size.

Sprockets.—State size, whether wrought, if ends shaped, and their position. If several varieties, begin with the smallest.

Eaves.—Describe the size and shape of eaves, fillets; the thickness, width, and finish of fascias.

Tilting Fillets.—Describe position of tilting fillets.

Gutters.—Describe thickness, width in the narrowest part, distance apart, and depth of drips; fall by inches in ten feet.

Describe gutters behind chimneys, skylights, &c., by an average width.

Cesspools.—Describe thickness of the deal, and state length, width, and depth in clear.

Snow Boards.—State size of battens and bearers, and the distance apart of both, and the lengths in which they shall be made.

Ways in Roof.—Generally so many feet of 1 in. rough boarding is provided, the quantity chargeable being adjusted at the settlement of accounts.

Flats.—Describe the timbers, thickness of boarding, degree of fall, size and distance apart of rolls, distance apart of drips, and their thickness. The joints of boarding are best laid parallel to the direction of the fall.

Dormers.—The woodwork of these is best described "Carpenter" and "Joiner" together. Describing them under two headings serves no good end, and it is an advantage to have them together, although it is a departure from the general scheme of classification. They may be located either by the points of compass or by the number of the room they light, Give scantlings of all timbers, describe the covering, as boarding and felt, the thickness of the cheeks, posts, head, sill, casement, and joiner's finishings.

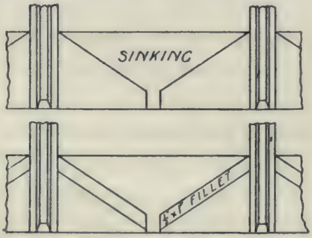
Skylights or Lanterns.—All as last.

Describe the thickness, whether moulded or chamfered, the distance apart of the bars, whether there are stiles at intervals, and if so their size. If the bars are larger than ordinary state their scantling.

If there are any special means for allowing the condensation water to escape describe them.

Skylights will rarely exclude the weather if they are less than 2 in. thick.

"The skylight over the fruit room shall be $2\frac{1}{4}$ in. moulded with 2 in. by $2\frac{1}{4}$ in. moulded bars, about 14 in. apart, with stiles 4 in. wide, moulded to match, and about 5 ft. 6 in. apart. The skylight shall be throated all around, and screwed with stout brass screws to the curb. Sink the bottom rail $\frac{1}{2}$ in. deep (Fig. 84) to allow of escape of condensation water, as sketch."



FIGS. 84 and 85.

Or,

> Instead of the sinkings, "nail with copper nails to the bottom of the skylight for its whole length a strip of stoutest boiler felt 6 in. wide."

Or,

> "Nail to the bottom rail of the skylight (Fig. 85), to allow of escape of condensed water, sets of two wrought teak fillets, $\frac{1}{2}$ in. by 1 in. by 7 in., disposed as sketch."

Traps in Ceiling or Roof.—State thickness and description of trap, linings, ironmongery.

Turrets, Flèches, &c.—These may reasonably be described in all trades at the end of the "Carpenter's" specification.

Ceiling Joists.—State scantlings of ceiling joists, stretchers, and hangers, and the distance apart of the two latter.

Quarter Partitions.—If they are not all alike, describe the exceptional ones first; stating their position by the points of compass is most convenient, as "the partition on northern side of bath-room to be," &c. Describe any ironwork, with the timber; a skeleton sketch of a trussed partition on the margin of the specification is sometimes useful. The remainder may be described together thus: "Construct all the other quarter partitions of heads, sills, posts, and braces $4\frac{1}{2}$ in. by 3 in.; quarters $4\frac{1}{2}$ in. by $2\frac{1}{4}$ in."

Floors.—The plates to floors throughout to be $4\frac{1}{2}$ in. by 3 in.; for the plates fitted to iron, describe the scantling, the sizes of bolts, and their distances apart.

Then describe the joists according to the designation of the

rooms, thus: "The joists to rooms 3, 4, and 5 to be 7 in. by $2\frac{1}{2}$; to rooms 10, 11, 12, 9 in. by 3 in.," &c.

Strutting.—Describe the strutting to floors, whether solid or herring-bone, the distance apart of the rows.

Sound Boarding.—State thickness and position, and whether single or double fillets.

The use of sound boarding in floors involves pugging of some kind, as a mixture of lime, sand, and chopped hay. The plasterer's ordinary coarse stuff, or silicate cotton or inodorous felt may be nailed on the joists over the whole surface beneath the boards, or strips of boiler felt, 3 in. wide, on every joist immediately under the boarding.

Sometimes flats are pugged where inconvenience from heat is expected. Sound boarding and either of the mixtures above mentioned, inodorous felt, silicate cotton, or a continuous layer

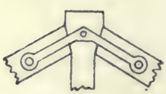


FIG. 86.

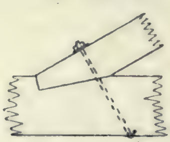


FIG. 87.

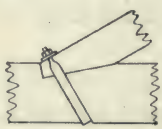


FIG. 88.

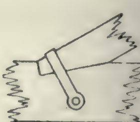


FIG. 89.

of boiler felt, and in special cases, sound boarding, silicate cotton, and boiler felt together.

Roofs.—Ordinary roof trusses require no special remark. It is clearest to describe King and Queen posts by the size of the original timber from which they are converted, as, "out of 9 in. by 4 in." The ordinary points to observe are few. There should be sufficient length of the tie beam to prevent shearing, and the whole of the timbers of the truss should be of the same thickness.

Straps and Bolts.—There is often a wasteful use of iron in securing roof trusses. A strap at the head of a King post is frequently used (Fig. 86), and is only necessary when the head of the King post is cut off to the rake of the rafters. If the work is properly framed it cannot move. Some architects put such a strap on one side of the truss, others on both sides. The foot of the principal rafter may either be secured by a *heel bolt* or a *strap* (Figs. 87, 88, 89), and the foot of the King post either with a *strap and bolts* (Fig. 91), *a strap and gibs and keys* (Fig. 91), or a bolt with *a hand-rail nut* (Fig. 92).

In special cases the straps may be enlarged, where the bolts pass through.

Sprockets.—Sometimes the rafters pitch on plates, one edge of which is fair with the internal face of the wall (Fig. 93). In such a case sprockets are unnecessary. Short lengths of rafter and an eaves fillet would be used. When a curved surface is required at the eaves the intention should be made clear by the specification. The simplest way to produce it is to saw the upper edges of the sprockets to the required contour (Fig. 94).

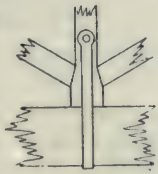


Fig. 90.

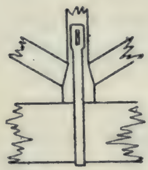


Fig. 91.

Fig. 92.

Eaves Board and Felting Fillet.—Roofs which have no boarding must have either an eaves board or an eaves fillet. When sprockets are used they may be dispensed with.

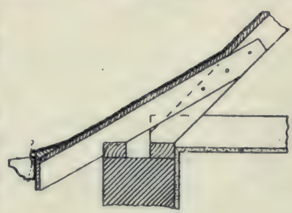


Fig. 93.

Fixing of Eaves-gutters.—Half-round gutters may be fixed either with brackets (Fig. 95) carried up the back of the rafters and screwed to them, or by brackets nailed or screwed to the face of the wall (Fig. 96).

Fascias.—Ogee or moulded gutters *may* be screwed to the rafters' feet, but often the hole in the back of a gutter does not coincide with a rafter, and such screw is omitted. It is best to have a $\frac{3}{4}$ in. rough fascia nailed (Fig. 97) to the rafters' feet, or a wrought and beaded one. Sometimes a flat soffit is used in addition.

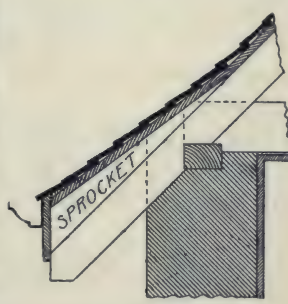


Fig. 94.

Tilting Fillets.—Tilting fillets should be used close to the wall where any raking surface of a roof adjoins a vertical face, whether finished with soakers or stepped flashing.

Secret Gutters.—When secret gutters are used the tilting fillet is kept away from the wall, and the lead dressed over it. The appearance is neater than stepped flashing, but the liability to

obstruction is a great objection, and the use of soakers is as effectual, and still neater.

Centering.—For ordinary openings only a general description is required. As the builder is responsible for the stability of the work, he takes care to have sufficiently strong centering, but the architect should know how it should be constructed, as the builder

FIG. 95.

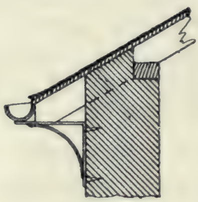


FIG. 96.

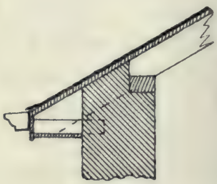


FIG. 97.

may err from ignorance. In the case of arches of very large span, the architect should draw a detail, figure all the scantlings, and refer to the drawing.

Or he may say, "The whole of the centering shall be of form and strength approved by the architect, and the contractor shall submit a drawing of each centre, which shall not be begun until he has approved it"; and this latter course is the better, as in the former case the architect adopts a responsibility which is not properly his.

Nailing and Spiking.—Spike is a word used to describe a large nail 4 ins. to 12 ins. long. The word is sometimes used in specifications in a most amusing way, as "1 in. by 1 in. fillet spiked on."

Thickness of Timbers.—Some architects avoid the use of timbers under $2\frac{1}{4}$ in. thick for nailing to, because they maintain that anything less is liable to split.

JOINER AND IRONMONGER.

Materials.—Describe the various woods to be used, and their quality.

The limitation of the size of knots is reasonable, thus:—

No knots shall exceed $\frac{1}{2}$ in. in diameter.

No method of describing deal is so effectual as by a shipping mark. This will ensure a general quality, although there will still be occasional defects, which must be observed.

The deals for joinery shall be Gromoff's shipper's first quality, or P B shipper's first quality.

There are other brands which indicate high quality. The foregoing are two which are very good.

Or,

> The deals for joinery shall be shipper's second quality Swedish or Russian brand.

Sometimes it is stipulated that the panels of framing shall be of best bright "St. John's or Quebec pine." Gilmour or Booth are shippers of the best. The advantage of its use is that the panels can be obtained without a joint.

Follow with the general stipulations which apply to the whole work, some of which are as follows:—

Glued Joints.—All glued joints to be cross-tongued.

Finished Sizes.—A similar clause to that in "Carpenter" if finished sizes are desired.

To provide against excessive waste, which sometimes occurs in the conversion of deal, when there is no stipulation for finished sizes, a clause like the following may be used:—

"One-eighth of an inch to be allowed on the several denominated thicknesses of superficial work, if wrought on both sides—viz., for 1 in. it must measure $\frac{7}{8}$ in., for $1\frac{1}{4}$ in. it must measure $1\frac{1}{8}$ in., and so on for the various thicknesses; but if planed on one side only, it must measure full $\frac{15}{16}$ in., or $1\frac{3}{16}$ in., as the case may be."

Sometimes a clause is used as follows:—

"All thicknesses specified are to be taken as nominal thicknesses, but only a sufficient allowance will be made for saw cut and planing short of the specified sizes, excepting to solid door and window frames, transomes and mouldings, which shall hold the full sizes specified." Not unfrequently this stipulation in the specification for finished sizes is forgotten when the details are made, and they are drawn with the ordinary allowance for working.

Secret Fixing.—State what work is to be secretly fixed, and how, as with slotted screws, slotted screws and plates, &c.

The work fixed with slotted screws should be specifically mentioned.

"The whole of the mahogany work to be secretly fixed, the architraves with brass screws and brass-slotted plates about 18 in. apart."

Joints of Floors.—Sometimes "if joints of flooring open $\frac{1}{16}$ in. before payment of final balance, the whole of the flooring of the room in question shall be taken up and relaid at the contractor's expense."

Sawdust.—State if floors, after laying, shall be covered with sawdust.

Cups and Screws.—State what work shall be fixed with cups and screws.

This costs very little, and is convenient. All the joinery over pipes and bell wires, the casings and joinery of waste-preventing cisterns, w.c.'s, baths, lavatories, the beads of sash frames, of casements, beads to glazed panels of doors, the beads to sash squares in doors, the beads to squares of sashes glazed with plate glass, and generally to any beads or mouldings which secure anything which may require removal or renewal.

Linings.—All linings to be tongued at angles and to frames, door linings over 11 in. wide to have dove-tailed backings.

When linings are framed in panels, the stiles should correspond with the stiles and rails of the doors, and the framing should match the doors in all cases. The labour should be described as single or double rebated, &c. If the rebate is on the solid, the total thickness would be described, if a lining with a stop nailed on, the two pieces should be described thus:—

"1 in. twice beaded linings with 3 in. by $\frac{1}{2}$ in. stop nailed on to form double rebate."

In decent work, door linings rebated on solid should not be less than $1\frac{1}{2}$ in. thick, otherwise the attachment of the hinges is not secure.

Iron Dowels.—All solid frames to be dowelled to the stone steps with $\frac{3}{4}$ in. by $\frac{3}{4}$ in. wrought-iron dowels.

Iron Shoes.—In places where very rough wear is anticipated iron shoes are sometimes used.

"Fit each door frame with 2 shoes of the same section as the frame, and of $\frac{1}{2}$ in. cast iron 3 in. high, with a stub 1 in. by 1 in. by $1\frac{1}{2}$ in. let into the stone step. The faces of the shoes to be flush with the faces of the frame."

Pipe Casing.—Describe pipe casing, and where it shall be used.

Pipe casing should be of similar wood to the joinery adjacent, and in the better parts of the building may be panelled. The grounds must always be rebated and beaded. Sometimes it is

convenient to form small doors at intervals for access to particular parts of the pipe or to stop-cocks.

"Where stop-cocks occur, form in the pipe casing a small flush-framed door, hung with 2 in. brass butts, and fitted with a strong turn buckle with brass knob. Rebate the door and pipe casing all around to form stop."

Or a certain quantity may be provided thus:

> "Provide 100 ft. superficial ¾ in. boxed pipe casing rebated and staff beaded at angles, and fixed with brass screws and cups, to 1¼ in. bended grounds plugged to wall and including mitres and fitted ends." The quantity used would be measured at completion and the provision adjusted.

Iron Tongues.—Describe iron tongues to connect sash sills with stone or brick sills.

Where brick sills are used a saw cut will produce the groove in the brick.

Bases to Architraves.—State which architraves have bases, and describe them and how attached.

When the architraves are not thick enough to stop the skirtings bases must always be used, and in good work they should project enough to allow of housing the skirting.

Grounds.—Describe various widths of grounds, where they shall be used, and which shall be framed.

Grounds should always be splayed on the edge next the plastering, and when used, to receive a detached rail, like a picture rail, with plastering above and below, twice splayed.

When used for the attachment of a broad piece of joinery skeleton grounds may be used with advantage, described thus:—

"The pilasters in hall shall be fixed to 1 in. by 3 in. framed and splayed skeleton grounds, the horizontal pieces of the same size, and about 2 ft. apart."

When grounds are wrought and form part of an architrave, state the thickness and width and the labour on them.

The boxing grounds for boxing shutters must be splayed. Describe thickness and width and the labour on them.

Ironmongery.—Builders' ironmongery varies very much in quality, and consequently in price. Those manufacturers who have a high reputation for their wares, such as among others Chubb, Hobbs, and Tucker & Reeves of London, and Gibbons of Wolverhampton for locks, Baldwin of Birmingham for butts, &c., are able to command high prices; but much of the

ironmongery in use is of very poor quality and low priced, and in the case of brass work the weight of the articles is reduced to the lowest possible limit.

Ironmongery should always be specified with the joinery upon which it is used; but in order to avoid repetition, any general clauses which affect the whole should appear in the preamble of general clauses in this trade, something like the following:—

"All ironmongery to be of the best town manufacture, and fixed with screws, the brass work with brass screws, all iron butts to be wrought."

"The locks and latches to be of manufacture" (state maker's name).

If the furniture is patent, state whose patent.

Describe the ironmongery with the joinery to which it is attached. In the case of wrought-iron hinges state the size of the iron, their length, and, if possible, the weight of each pair and its appurtenances, state if they have back straps and how fixed. Special articles of ironmongery may be conveniently described by their number in a trade list.

When it is essential that ironmongery shall be of very good quality, it is a frequent practice to specify the prime cost of each of the articles, or to select a manufacturer to whom a list of the ironmongery may be sent to affix his prices, the total sum may then be included in the specification as a provision.

State in all cases whether the article is of brass, iron, or gun-metal.

Ironmongery as a Provision.—When a provision is made for ironmongery, the amount would be written in the section Provisions, and here would occur the direction for contractor to fix and the statement that a sum is provided.

Sometimes in the case of churches or other public buildings it may be convenient to state a P. C. sum for the ironmongery of a particular door, enumerating the articles so that the builder may know what he has to fix, thus:—

"Provide for north door 1 pair of strap hinges, 1 stock lock, and 2 iron ornamental bolts, £5 P. C., in all at warehouse, and fix them."

Master Keys.—State what locks shall be under one mastership, and the number of master keys. Every face-plate of the locks and every key should be engraved with a corresponding number. In cases of mastership, the locks should be good, as locks,

according to their quality, may vary in capacity from 50 to 500 permutations. See page 81.

Attendances.—Special attendances may follow here.

Reference of Ironmongery to Specimens or Samples.—Some public departments refer articles of ironmongery to the quality of specimens in the architect's office, thus:—

All locks to be equal in quality to specimens to be seen at the architect's office.

Although the ironmongery may be provisional, it should be described with the joinery in the usual way.

Butts.—State size, if the broad suit say so, or state width, state if rising or projecting, if with steel washers and pins, if with face plates, and whether the face plates are engraved.

Some architects specify one and a half pairs of butts for a heavy door; the accuracy of fixing required to ensure an equal quantity of work from each of the three butts is rarely obtained, and it is better to use one pair and increase their size. A Scottish fashion is the use of unusually large butts. A pair of 6 in. butts to an ordinary 2 in. door is not uncommon.

Cross Garnets.—State length and whether extra strong.

Strap Hinges.—State length, size of iron, if with back straps, if with fanged or double-fanged hooks, if with screwed plates, if bolted, state the size of bolts and the number to each hinge. Sometimes it may be convenient to state the weight.

Patent Hinges.—Describe the kind, if swing, the thickness of the door they are for, whether single or double action, that they shall be adjusted at completion and the boxes filled with Neat's foot oil or glycerine.

If spring hinges state the size and name of maker.

Ornamental Hinges.—If cast-iron hinge fronts they may generally be most conveniently selected from an illustrated trade catalogue, state the number in the trade catalogue and the name of the maker. If wrought-iron ornamental hinges are required to design it will be better to provide a sum per pair, the fixing being either described separately or included in the amount provided. The sum to be provided is the more likely to be reasonable if the detail drawing be sent to an iron-worker for a price, and if sent to several of equal ability the advantage of a competitive price may be obtained.

Bolts.—State the length and whether tower, barrel, bright rod, necked, brass mounted, square, monkey-tailed. These last are

described by their total length and may be specified by a number in a trade list. If they are wrought-iron ornamental they may be treated as suggested for ornamental hinges.

Flush Bolts.—State length and width, whether with knob, Showell's patent sunk slide, Groombridge's patent cycle stop, Locke's patent self-locking flush snib, &c. The advantage of a handle over an ordinary slide is considerable, and still more if it can be put out of the way when not in use.

Indicating Bolts.—State whose patent. Showell's patent indicating bolt. Ashwell's special "Navy" gun-metal polished indicating bolt. These are used on w.c. doors to show when they are occupied.

Espagneolette Bolts.—State the diameter of the bolt, whether all brass and what parts are iron, and whether to bolt top and bottom. The kind of furniture. The more ornamental ones are best described by a number from a trade list.

Weather-tight Casement fastenings. — Archibald Smith and Stevens' is a good one; use the description from their trade list.

They are only necessary for folding casements, and a hook-rebate will generally serve the same purpose.

Sill Bar.—Archibald Smith and Stevens' is a good one; use the description from the trade list. It may be applied to either single or folding casements.

For casements which open outwards there are various ordinary joiners' expedients which will exclude the weather. When casements open inwards the difficulty is great, and some mechanical contrivance such as this must be used.

One of the discomforts involved by the opening of casements inwards is the disturbance of curtains.

For casements which open outwards an ordinary zinc or galvanized iron bar for the casement to shut against is all that is required.

Locks.—State size and kind as iron rim, brass rim, mortise, drawback, dead or stock, whether three bolt, two bolt, if rebated or half-rebated, and the kind of furniture.

Oak stock locks with wrought-iron mountings to design are best treated as suggested for iron ornamental hinges.

When ornamental furniture is required it is best described by number from a trade list, and if patent say whose patent.

Brass furniture may be described by the size of the knob, and

if patent whose patent, as Mace's, Hobbs & Co. patent double-spindled, &c.

Sliding doors, of which the edges meet, will require a clutch lock, and probably flush furniture. Small sliding doors will sometimes require a pedestal lock.

Sometimes for warehouse doors locked from the outside, and in cases where a lock is considered an insufficient protection a combination of lock and bolts is used. Hobbs' patent protector lever rim combination lock and bolts is one kind.

Finger Plates.—Describe by number from a trade list. State how many to each door. Do not describe them as sets, a word likely to be interpreted in various ways.

Sash Fastenings.—State the length and quality. These are best described by a number from a trade list, if patent state whose patent.

When a meeting rail is too far from the floor to be easily reached, top and bottom sash fastenings may be used. Gibbons (Wolverhampton) supplies a convenient kind.

The top sash fastener may be worked with a "long arm," but is best combined with cords and handles to open or secure the top sash. The bottom sash fastener is a combined lift and fastener, and the whole is thus described, "Fit each dining-room window with Gibbons' (Wolverhampton) set of top fasteners, comprising one fastener, two mortise pulleys, one cord plate, best fine flax lines, two cocus-wood and two box-wood handles, and one set of two bottom lifts and fasteners." If silk cords and better handles are required they must be described.

The foregoing arrangement actuates each of the two sashes separately.

Meakin's apparatus opens or shuts the top and bottom sash simultaneously, and when shut fastens them. Describe thus:

"Fit each dining-room window with Meakin's (Baker Street, London) self-acting sash fastener and opener, with their special flax lines, satin wood and ebony handles, pulleys and locking plates."

If the lines are to be silk or the handles of better quality specify them.

Sash Centres.—State length and quality and if bushed.

Sash Handles.—State length.

Sash Lifts.—State length and if sunk.

Wire Netting.—State the size of the mesh, the wire and the

frame, and how fixed, and whether movable (for convenience of cleaning the glass). If to skylights describe bars to which it may be attached.

"Protect the two eastern windows of the boys' classroom by covering the whole of the frame and sashes with $\frac{1}{2}$ in. mesh galvanized straight wire work, No. 8 B. W. G. frame, No. 10 B. W. G. ribs or cross bars, and No. 12 B. W. G. uprights, the ribs to be 4 in. apart, fixed with galvanized wire staples to the frames in three sections to each window, hinged and secured by a Hobbs & Co. $1\frac{1}{4}$ in. brass padlock."

"Protect the whole surface of the skylight over w.c.'s with wire netting, as last secured by stout galvanized iron wire to $1\frac{1}{4}$ in. by $\frac{3}{16}$ths in. galvanized wrought-iron bars about 14 in. apart, with ends flanged and screwed with screws, with countersunk heads, put longitudinal supports transverse to the bars about 15 in. apart and passing through them of $\frac{3}{8}$ in. diameter galvanized iron wire."

Sash Pulleys.—These vary greatly in quality, and if good ones are required it is not sufficient to describe them as "best brass axle pulleys." Specially good ones are made by Meakin (Baker Street, London), and Gibbons (Wolverhampton). They may be described in accord with their trade list.

The description of the general work should follow the order of floors, skirtings, dados, windows, doors, fittings. If several kinds of wood are used, the order would be—floors in deal, floors in pitch-pine, floors in oak ; skirtings in deal, skirtings in pitch-pine, skirtings in oak, &c.

The joinery of a large building should be described, floor by floor, in the above order : as ground floor, first floor, &c. When the building is small the same order may be adopted, but not divided into floors.

If the writer does not write a separate section for deal and each better kind of wood, it will be convenient to commence the description of w.c. or bath fittings or similar work with the words, "The following to be in mahogany," &c. He need not then repeat the word mahogany throughout the remainder of the description.

Floors.—State the quality and thickness, and whether deal or batten ; if of narrower widths than ordinary, state it ; say whether rough, edges shot, laid folding, straight joint, splayed headings, tongued headings, dowelled, grooved, side nailed,

tongued, and the kind of tongues; if iron tongues, the gauge of the iron; and whether painted tongues, and how many oils; if traversed and cleaned off at completion; if punched and puttied; if covered with sawdust after laying.

After the floors the steps between one level of floor and another and sinkings for mats may be described. The borders may be of iron, slate, or wood; the two former are suitable for tile or cement floors.

Sub-Floors.—A sub-floor must be described to receive oak or parquetry.

Wood-Block Floors.—The patent kinds may be either treated as a provision or a P. C., price per yard, including laying, may be specified. They are best laid by the patentee, and the specification should make that stipulation. They may be of deal or hard wood.

White, Geary, Duffy, Lowe, Gregory, Goddard, Westminster Patent Flooring Company, are some of the makers of patent flooring.

For wood block floors of the ordinary kind, state what wood, the size of the blocks, how laid, as herring bone, if bordered, if blocks are gauged and what they are laid in, as tar, mastic, &c., if traversed and cleaned off at completion.

"Lay the floors of w.c.'s with wrought yellow deal blocks, 3 in. wide, 4 in. deep, and 9 in. long; every block gauged, dipped in Stockholm tar, jointed with boiling pitch, tar, and sand, and cleaned off at completion."

Skirtings.—Describe the thickness, the height, whether square or moulded, if the moulding is of unusual girth, or separate, state its girth or size. If the skirting is in two or more pieces, state the size of each and how put together. If tongued to floor, describe it.

For skirtings in several pieces a sketch in the margin of the specification is reasonable.

It is expedient to mould the wall strings of staircases to match the skirtings adjacent.

Dados.—Describe the thickness and how fixed, whether with grounds and how many, whether matched boarding or V-jointed boarding, and if either the widths of the boards, how the angles are finished, the capping, the skirting.

If framed state the thickness of the framing, whether flush framed at back, moulded, keyed, glued and canvassed at the back.

Sashes and Frames.—Describe the thickness of the outside, inside, and back linings, and of the pulley stiles; whether the pulley stiles are of a different wood (as mahogany); whether the inside linings are of a different wood (a room fitted in pitch-pine or oak often has sashes of deal, and the inside linings of the frame of the same wood as the fittings); the size of sill, and whether of oak, teak, or pitch-pine; its section as sunk, double sunk, weathered, throated, check-throated; the thickness of the sashes; whether moulded or chamfered; if with small squares; if extra large bars, the size of them should be stated; whether hung with iron or lead weights, the latter are generally necessary when the glazing is of plate glass; if with parting slips of stout zinc; describe lines (specially good lines should be described by number from a trade list); whether sashes are single or double hung or fixed. If in frames of more than one light, state which of the lights are to be hung and which fixed.

Describe the horns to the sashes, and whether they shall be used for both top and bottom sashes; also whether the mouldings and rebates shall be stopped, so that the full size of the stiles may be maintained.

Describe the ironmongery with the joinery.

Describe the linings; whether framed, and how many panels; whether moulded. The window boards, and the moulding beneath (if any); the window backs, their thickness, how many panels, and whether moulded. The architraves, and if in two pieces, state the size of each piece.

If the window backs are canvassed and glued, describe it. If the window backs are thus treated throughout the building, the item may reasonably appear among the general items at the beginning of the trade.

Fig. 98.

Fig. 99.

If there are any special labours on the sashes, as splay rebated meeting rail, or splay rebated and grooved bottom rail, describe them.

Casements and Frames.—Describe the size of the frame, the size of sill, and what wood. The sizes of mullions and transomes, and the labours on them. The thickness of the casements, whether moulded or chamfered, if with bars, and if the bars are extra large, state the size, any extra labours on the casements, and which are fixed and which to open. The opening ones may be indicated by marks on the elevations, and may be here referred to.

Describe the ironmongery, window boards, linings, window backs, and architraves.

The various expedients for excluding the weather may be here given. A simple one is the grooving of the frame and the top edge and sides of the casement, as sketch (Fig. 100). This may be applied to casements opening either inward or outward.

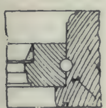


Fig. 100.

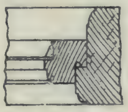


Fig. 101.

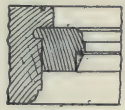


Fig. 102.

Fig. 103.

Rebating and rounding the vertical edges of the casement with a corresponding groove on the frame, as sketch (Fig. 101). This may be applied to casements opening either inward or outward.

A rebate and groove on the shutting stile, as sketch (Fig. 102). This may be applied to casements opening either inwards or outwards.

Fig. 104.

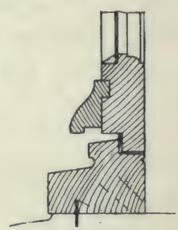


Fig. 105.

A hook rebate on the meeting stiles of folding casements, sometimes a fillet moulded (or otherwise) in addition (Fig. 103). This may be applied to casements opening either inwards or outwards.

The sills are best double sunk and check throated (Fig. 104), and the bottom rail of the casement splay is rebated and grooved. A metal water bar may also be used. This applies to casements opening outwards.

This arrangement is also applicable to transomes.

Fig. 106.

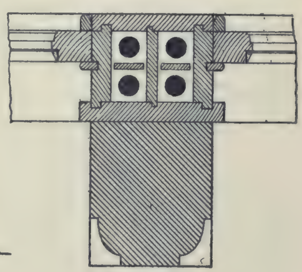


Fig. 107.

When the casements open inwards the difficulty of excluding the weather is much greater. In addition to some of the foregoing arrangements—

A weather fillet may be used on the bottom rails (Fig. 105). A water bar, with outlets, as Fig. 106.

But nothing is so effectual as Smith's sill bar (Fig. 107).

The question of the respective merits of casements and frames and sashes and frames will present itself to the architect in various ways. Of the superiority of sashes and frames for the exclusion of weather, convenience of opening, and facility of cleaning there can be no question. On the other hand, the casement and frame lends itself much more readily to picturesque treatment and without the use of stonework.

The same architectural effect can, however, be obtained by using stonework in the windows and placing sashes and frames behind it, as Fig. 106. The meeting rails, which may be placed at the level of the stone transomes, will be specially wide.

N.A.P. Principle.—There are several patents in use for facilitating the cleaning of windows from the inside. Of these the N.A.P. principle is about the best. They may be specified, so that the sashes and frames, as well as the fittings, may be supplied and fixed by the patentees, or only the fittings supplied by them. If the latter, the following may be used:—

"Fit the window openings numbered 12 to 43 both inclusive with 2 in. moulded N.A.P. sliding and revolving sashes, double-hung with N.A.P. No. 13 2 in. brass-faced axle pulleys, best No.   flax lines, and iron weights in deal cased frames of 1 in. inside and outside linings, 1¼ in. pulley stiles and heads, ½ in. back linings, ⅝ in. by 1 in. inside beads screwed with brass screws and cups, 1 in. by 3 in. bead on sill for ventilation, and stout zinc parting slips.

"The meeting rails of sashes to be 1¾ in. thick, bevelled and rebated, and the stiles of the top sashes to have moulded horns. The whole to be tongued and grooved together, and the inside linings grooved all around to receive the finishings.

"In place of the ordinary sash stile supply two stiles to form the side of each sash, described as the cord stile and the glass stile.

"Corrugate and groove the abutting faces of the cord stile and glass stile, and run a bead inside and outside of each cord stile to break joint. The whole to be made and fitted in accordance with the N.A.P. Company's patent.

"Fit each sash with a set of patent N.A.P. sliding and revolving window fittings with sunk screws and check action centres. List Price, 14*s.* 6*d.* per set.

"Varnish the corrugated faces of the stiles with Harland's 'bone dry' varnish."

If intended to be made and fixed by the company, add the words "the whole to be made and fixed by the N.A.P. Company."

These sashes may also be fitted with stile locks so that they may be kept open a certain distance. Convenient for windows of lunatic asylums.

Doors.—Describe thickness, size (as 3 ft. by 7 ft.), the kind, if moulded, and whether one or both sides; if open for glass, if diminished stiles, the butts, the lock, thickness and description of linings, size and kind of architrave. Describe doors in screens with the screens.

Sometimes tables of doors for the whole building are inserted, making one for each kind of wood, something like the table on p. 149.

Position.	No.	Size.	No. of panels.	Description.	Pairs Butts.	Linings.	Architraves.	Locks.	Other Fastenings.
Third Floor—Bedrooms, 1, 2, 3, 4, 5, 6 . .	6	ft. in. ft. in. 2 10 by 6 6	4	1½ in. square framed	3½ in. iron	1½ in. double rebated	1¼ by 2¼ moulded	6 in. mortise and brass furniture	
Cistern room .	1	2 6 by 6 6	4	1½ in. ditto	ditto	ditto	ditto	ditto	
Second Floor—Bedrooms, 7, 8, 9, 10, 11 . . .	5	3 0 by 7 0	5	2 in. moulded both sides	ditto	ditto	1¼ by 3 moulded	ditto	2 long and 2 short brass finger-plates, P.C. 3*s*. each
(A) Bath-room	1	2 6 by 7 0	5	2 in. ditto	ditto	ditto	ditto	ditto	
(B) Linen . .	1	2 6 by 7 0	5	2 in. moulded and square	ditto	ditto	1¼ by 3 one side, 1¼ by 2¼ the other	ditto	
W.C.	1	2 6 by 7 0	5	2 in. moulded both sides	ditto	ditto	ditto	5 in. brass mortise latch and brass furniture	5 in. brass bolt

It will sometimes be necessary to increase the table by another column, headed Further Particulars, in which fanlights, transomes, &c., may be described; or a letter, as A, B, &c., may be prefixed to the description of any particular door, and after the table clauses relating to those letters. Thus:—

Notes to Table of Doors.

(A) The doors marked A are to have 2 in. moulded fanlights in single squares, with transomes 2 in. thick to match the jamb linings.

(B) The doors marked B are to have 2 in. moulded fanlights with $1\frac{1}{2}$ in. moulded bars, and to be hung with 3 in. brass centres with steel bushes; finished on both sides with cut beads, and fitted with best flax lines, brass pulley and eye, and brass cleat, 2 in. plain transome, twice ovolo-moulded on both edges.

Follow with doors in other woods in a similar manner. A table for each wood, and those woods of least value first.

Ledged Doors.—A "1 in. proper ledged door" was held to mean a door with 1 in. ledges, covered with 1 in. matched and beaded boarding. It is better, however, to describe them in detail, thus:—

"The doors to wood house and coal house to be 2 ft. 9 in. by 6 ft. 9 in., 1 in. matched and beaded in 7 in. widths with 1 in. ledges chamfered both edges. Hang with 15 in. cross garnet hinges to $4\frac{1}{2}$ in. by 3 in. rebated and beaded frames. Fit with strong Norfolk thumb latches." Sometimes these doors are braced as well as ledged. They cannot conveniently be hung with butts. They are only used for the commonest work.

Framed and Braced Doors.—These, if of the ordinary character, may be used for outhouses, stables, and basements. State the *total* thickness, whether braced, cross-braced, stop chamfered, whether covered or filled in with boarding, thickness of boarding and the widths of the boards, if grooved, tongued, V-jointed or beaded one or both sides, if filled in diagonally. Describe the ironmongery and frames with the doors.

The sizes of the rails, stiles, and braces should be described if good work is required. The commoner doors of this kind have the bottom and middle rail 9 in. wide, the stiles, top rails and braces $4\frac{1}{2}$ in. wide. The better ones have the bottom rail 11 in. wide and middle rails 9 in. or 11 in. wide. The stiles, top rails, and braces of batten width or half plank wide.

"The door of wood house to be 3 ft. by 7 ft., 2 in. framed and braced, the bottom rail 11 in. wide, the middle rail 9 in. wide, the braces, top rails, and stiles $5\frac{1}{2}$ in. wide, chamfered on all exposed edges, filled in with 1 in. grooved, tongued, and V-jointed both sides boarding in 4 in. widths. Hang with 4 in. wrought iron butts to 5 in. by 4 in. rebated and twice beaded frame. Fit with upright mortise dead lock, P. C. 5*s*., and strong Norfolk thumb latch."

This kind of door is sometimes converted on the inside into a number of panels, as Fig. 108, and thus described:—

"The door of kitchen entrance to be 3 ft. by 7 ft., 2 in. framed, door of bottom rail 9 in. wide, stiles and rails 4½ in. wide, showing one panel outside and converted on the inside into six panels, the stiles and rails ovolo-moulded on exposed edges, except to the upper edges of rails, which shall be chamfered, fill in with 1 in. grooved, tongued, and beaded both sides boarding in 4 in. widths. Hang with 4 in. wrought-iron butts to 5 in. by 4 in. rebated and twice ovolo-moulded frame. Fit with two 9 in. Tower bolts and 6 in. upright mortise lock, with Hobbs & Co.'s brass and brass-bronzed double spindle furniture. Finish on the inside with 1 in. by 3 in. twice ovolo-moulded architrave."

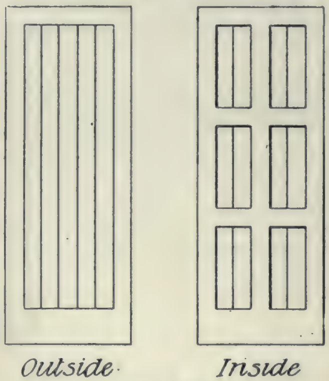


FIG. 108.

Sometimes it is easier to describe ornamental framed and braced doors as "to detail."

Panelled Doors.—Describe the thickness, the number of panels, whether square framed, bead flush, bead butt, moulded, and whether one or both sides, bolection moulded. If this last, state if mouldings are rebated to the stiles and rails, whether mouldings are tongued in, and whether tongued and mitred at angles. Describe the ironmongery with the door.

"Square framed" means square framed both sides. "Moulded and square" means square framed one side and moulded the other.

In describing folding doors describe the number of panels per set, not the number in each leaf.

Glazed Doors.—Describe the thickness, the number of panels, how finished on both sides, whether diminished stiles, whether mouldings or beads for the glass, whether moulded bars, and if bars are of unusually large size state their size.

Doors with raised Panels.—State whether the panels are raised on one or both sides, and whether any moulding is required on the raisings.

Door Frames.—Describe size, if rebated, chamfered, or twice chamfered, beaded or twice beaded, moulded or twice moulded. When the doors are segmental headed, describe whether the

head of the frame shall show square on the inside, and where possible state the size it is out of, the junctions of straight, and segmental or semicircular should be described as connected by oak keys and wedges or joint screws.

Framings.—Describe the thickness, the nature of the panels, and the number in height. If the upper part has moulded bars for glass describe them, and if the bars are unusually large state their size. Describe special framings, as of the top rail around girders, any special attachment as to columns, and the formation of doorways therein, which are sometimes rebated at sides and top to form stops, or a stop is nailed or screwed on. If there are quadrant corners, describe whether solid or framing of similar thickness; describe the joints between the circular and straight.

Fittings.

Cupboards.—Describe their positions by the numbers of the rooms; state thickness of front; how finished at angles; thickness and kind of doors; the ironmongery. Describe top and shelves, rails and pegs.

W.C. Fittings.—If pedestal closets, the seats would probably be supplied by the manufacturer of the apparatus, and would be best described in the "Internal Plumber."

If all of mahogany, or any wood more expensive than deal, say: "The following to be of mahogany."

If seats, risers and flaps, describe the thickness of the parts, and the ironmongery; state how fitted to remove. Whether with oak button blocks and brass cups and screws, or part to slide. If the seats (as well as the flaps) are hinged, describe them.

Describe the skirting, or back and elbows.

Bath Fittings.—Describe thickness; how the edges of top and its perforation are treated. The inclosure, its thickness, if panelled, square, or moulded; describe the door, and how hung, and its ironmongery. Describe skirting or back and elbows, their thickness and height and girth of moulding to upper edges. Say how the fittings are to be made movable. Specify a stout deal cradle for bath, and a step, if desired.

Cisterns and Sinks.—State thickness of bottom, and if screwed on; thickness of sides, and if dove-tailed angles; whether wrought outside. Describe blocking up from floor if required.

Describe capping to sinks, and if of oak, and how fixed; flashing board or skirting, giving width and thickness. The clear dimensions of length, width, and depth should also be given.

Dresser.—Describe in detail, and state its length, width, and height. Sometimes a provision of money is made for this, and a detail furnished later. A curious clause, "Supply one proper dresser," is not entirely unknown.

Ladders.—State size of sides and rounds, width of ladder, distance apart of rounds, whether folding, and describe the ironwork.

Provision of Material.—Sometimes a provision of material is made, as, for instance, "Provide 100 ft. supl. of 1 in., wrought both sides, shelving and bearers, to be used as directed, or deducted if not required."

Plate Racks.—Describe size and the parts thus:—

"Deal framed plate rack 5 ft. long, and to take three rows of full-sized plates, of $1\frac{1}{2}$ in. by 2 in. frame, and $\frac{1}{2}$ in. diameter round bars $2\frac{1}{2}$ in. apart."

Draining Boards.—State size and thickness, that it is blocked up to falls, and describe the groovings thus:—

"$1\frac{1}{2}$ in. draining board with grooves $\frac{1}{2}$ in. deep, 1 in. wide, and $\frac{1}{2}$ in. apart, prepared to receive lead and blocked up to falls."

Copper Lids.—State what wood, thickness and diameter, whether in two thicknesses, if pinned with oak pins, if dowelled together, and describe the handle.

"Deal copper lid 24 in. diameter of two thicknesses of $\frac{3}{4}$ in., pinned and dowelled together with oak pins, and deal shouldered handle pinned on with oak pins."

Pilasters.—Describe the thickness, if with returns, whether glued and blocked, any labour to angles, if entasis, and how fixed, as screwed, or with slotted screws. Describe the caps and bases.

"Construct the pilasters in vestibule of $1\frac{1}{4}$ in. deal with $1\frac{1}{4}$ in. returns, the angles tongued, glued, and blocked. The caps to be of 3 ft. by $3\frac{1}{2}$ in. moulding, rebated on back edge and let in to the pilaster.

"The neckings to be of $1\frac{1}{2}$ in. by $1\frac{1}{4}$ in. moulding, rebated on back edge and let in, the bases to be of $1\frac{1}{2}$ in. deal 9 in. high, moulded 4 in. girth, and planted on."

Wooden Columns.—Describe material and thickness and how put together, the caps and bases, the height, if with entasis, if fluted, carving (if any).

"Construct the colonnade across the inner hall to detail of best selected bright yellow pine, all glued and tongued together, of two turned diminished columns with entasis and fluted shafts of 2 in. stuff, the shafts 12 in. extreme diameter, rebated at each end to receive the caps and bases. The caps to be moulded and enriched Roman Ionic, glued up in pieces for carving."

"The bases to be moulded attic bases 7 in. high. The pilasters next wall to be constructed to match the columns. The whole to be put together in the best manner."

Access to Cistern Bottom.—Cisterns should always be so fixed as to give access to the connections beneath. In a cistern room this may be done by supporting it by bearers 11 in. deep laid on the floor, or by special bearers above the level of the floor.

Casing to Cistern.—Generally a cover is all that is necessary to a cistern when indoors. Describe thus:—

"Supply to cistern 1 in. matched and beaded cover. Ledge a part as flap, and hang with 12 in. cross garnet hinges."

When a cistern is out of doors it requires an entire casing. One way is as follows:—

"Case the cistern on flat with two thicknesses of $\frac{3}{4}$ in. matched and beaded boarding, blocked 2 in. apart, and filled in with closely packed slag wool. The top to be of $\frac{3}{4}$ in. matched and beaded boarding and 1 in. cover with double chamfered water fillets, the upper cover to be fixed to slight fall. The two thicknesses of the top to have a 2 in. space between packed with slag wool as before. Form door in this top hung with 18 in. cross garnets of construction uniform with the remainder of the top."

Cisterns when exposed in an apartment would be cased with framing to correspond with the joinery adjacent.

Casing Waste-preventing Cisterns.—In exposed situations waste-preventing cisterns are often cased. They would also be cased in lunatic asylums. To certain mental conditions a waste-preventer is a constant temptation to hang one's self. Describe thus:—

"Case the waste-preventing cistern in external w.c.'s with $\frac{3}{4}$ in. matched and beaded boarding in 4 in. widths, ledged in five pieces, and fixed with screws to $2\frac{1}{2}$ in. by 2 in. framed cradling fixed to the brickwork. Nail to the inside of the whole covering 48 ozs. boiler felt, well lapped."

Staircases.—Describe the thickness of the treads and risers, whether rounded or moulded nosings; state how many fir

carriages, if glued, blocked, and bracketed, if grooved and rebated together, if screwed together, if mitred to cutstring. Describe thickness of strings, and the labour on them; if in two pieces describe the size of each, and how put together. Specify winders and landings as cross-tongued. Describe curtail or other ends to bottom steps; specify sizes of newels, and the labours on them; state sizes of balusters, and their description as turned—square-turned, or square—and how fixed to string and handrail.

Specify wood and size of handrail, and the labours on it. If fitted to an iron-core rail, the latter and any iron balusters or newels may conveniently be described here, or say in this place, "For core, rail, and balusters, see 'Founder and Smith.'" Turned or square-turned balusters are not unfrequently described by a number in a trade list.

Specify the finish of the well hole as nosings and aprons, stating size and the labours on them.

Deal Cornices.—State the girth of the moulding, how it is put together, and the thickness of the wood, thus:—

"Put all round the library a cornice 18 in. girth of 2 in. deal, all rebated together, glued, and blocked."

Church Fittings.—In the case of church fittings, it is desirable to specify that a pattern bench shall be made and submitted to the architect before the whole of them are put in hand, "and allow for carriage to and from the building."

They are best described by reference to details.

For pulpits, lecterns, and prayer desks, a sum is usually provided.

Oak Joinery.

Oak Joinery Demands Special Care.—If good results are desired, joinery of oak requires special care both in its specification and supervision.

English Oak.—Well-seasoned, well-grown English oak is the strongest oak procurable. English oak is still commonly used for fences, sash sills, and other external work. These are generally sawn out of comparatively small trees, under 2 ft. diameter, and as a consequence they warp, twist, and crack in a very unsightly way. Oak gate posts, as a rule, are the squared trunks of small trees, with the pith in the middle, and cannot be reasonably expected to stand the weather. Boring a hole 1 in.

or more in diameter through the whole length of the post is a precaution which preserves them to some extent.

Seasoning of Oak.—But no oak can be depended upon which is derived from such sources. The trees which furnish it should be not less than 5 ft. in diameter, should be winter felled, and should be seasoned for a long time, first in the log (three years or so), then sawn into plank, and left for another similar period for further seasoning. English oak which will satisfy such conditions as the foregoing will cost from 7*s*. to 10*s*. per foot cube, without any further labour beyond sawing into scantlings.

Oak from a Special District.—Such a stipulation (sometimes seen in specifications) as that the wood shall be grown in a particular county is impracticable.

For internal joinery good foreign oak is often preferred. English oak, seasoned to the extent described, is very hard; the foreign oak works easier, and is not so liable to warping and splitting as the English.

Foreign Oak.—Baltic oak has been much used, known as Riga, Dantzic, Stettin, or Memel. Riga wainscot makes good work, but it is scarce, and Austrian or Hungarian is now most plentiful. This is shipped from Fiume or Trieste in exceptionally large logs or wide planks of very fine quality.

Oak Staves.—Sometimes staves have been used, but really good staves are now very expensive. In the specification of the Houses of Parliament the following clause occurred :—

"The wainscot to be used in the joiners' work is assumed to be from the best Crown Riga wainscot in the logs, and from pipe staves of the best quality in equal proportions, to be prepared for use by steaming or otherwise."

Riga staves are so dear that they are now imported but rarely. Memel and Stettin are of good quality, but are not much used by builders, as stuff of larger size is found to cut up to greater advantage.

Large Members should be in Sections.—Columns, large mullions, mouldings, and cornices should, as far as possible, be made in sections cross-tongued together.

Frames should be made up of pieces of oak, cross-tongued to a well-seasoned deal core.

It should be the rule to avoid large pieces of wood wherever possible. Posts and members of roof trusses must, however, be of the solid wood.

Causes of Failure of Oak Joinery.—The ordinary practice of laying mouldings into the panels, as with soft wood joinery, is another cause of failure. The mouldings should be worked on the solid, and should be treated with "turn-out" or "run-out" stops if mitres are not required; if they are, the mitres should be mason's mitres, as they are called, and these mitres should be worked after the framings are glued together.

Fumigation of Oak.—Internal joinery is nearly always fumigated, and is often left unpolished.

Precautions.—If the fixing of such work as dadoes can be postponed until the walls are dry it will be the more likely to stand without cracking or warping. Canvassing and glueing over the whole surface of the back is, however, some protection.

The angles of all mouldings should be tongued, mitred, and screwed together.

Some of the clauses which will assist the architect to procure good oak joinery are as follows:—

Description of Oak.—"The oak shall be of the best quality, out of trees of not less than 5 ft. diameter, seasoned in the log for three years, then cut into plank, and seasoned for another three years, cut as far as possible on the quarter, free from sap, shakes, large, loose, or dead knots, stains, and all other defects, and carefully matched for colour and figure."

Oak Joinery.—"The joinery shall have double tenons to all framings where the thickness exceeds $1\frac{1}{4}$ in.

"All oak window backs, dadoes, and similar framings and doors are to be moulded to detail on solid, with mason's mitres, and these mitres shall be worked after the framings are glued up.

"All oak window backs, dadoes, and similar framings, where bolection mouldings occur, shall have the moulding rebated, tongued, and glued to the stiles and rails, and screwed from the back.

"All doors bolection moulded shall have the mouldings rebated, tongued, and glued to the stiles and rails.

"The whole of the internal oak joinery shall be fumigated to an approved tint.

"The backs of all dadoes, window backs, and similar framings next the walls shall be canvassed all over with stout canvas, glued on, and afterwards painted with two coats of oil and red lead.

"Those parts of the work which are made up in sections shall

be tongued with hard wood cross-tongues, and tongued and carefully glued together.

"The whole of the wrought surfaces shall be finished with the plane, chisel, or scraper, and glass-paper shall on no account be used."

For treatment of frames made up in sections see pages 93 and 96.

Mahogany Joinery.

General Treatment of Mahogany Joinery.—Mahogany may be specified on the same general principles as suggested for oak. The building up in sections, the treatment of the mouldings and surfaces, are the same except for fumigation, which is exclusively applied to oak.

Cedar sometimes substituted for Mahogany.—Cedar is sometimes substituted for mahogany, and it, as well as much of the commoner mahogany, is stained.

Kinds of Mahogany.—Cuba mahogany is about the best that comes into the market, but the bulk of the mahogany used is Honduras or Tabasco, both of which can be obtained of very good quality. A few clauses suitable for general purposes are as follows :—

"The mahogany shall be Cuba (or Tabasco or Honduras), of good figure, free from shakes, large, loose, or dead knots, stains, or other imperfections, and thoroughly dry and well seasoned."

Or,

"The mahogany shall be Cuba, of figure and quality equal to a sample to be seen in the architect's office, free from shakes, large, loose, or dead knots, stains, or other imperfections, and thoroughly dry and well seasoned."

Veneering in Mahogany.—When very beautiful work is desired it must be veneered, and if this veneering is done on well-seasoned Honduras mahogany it will stand nearly as well as solid mahogany. The mouldings would of course be solid, and may be laid in, as in deal work. As the mahogany in good veneer is very expensive its quality should be regulated by reference to a sample to be seen in the architect's office, thus :—

"The doors of the drawing-rooms shall be of Honduras mahogany, as described, veneered in the best manner with Cuba

mahogany, of figure and quality equal to a sample of veneer to be seen in the architect's office. The veneer at the arrises of the doors shall be carefully and truly mitred."

Teak.

Ordinary Uses for Teak.—Teak is frequently used for sills of sash frames, internal fittings, as dados, chimney-pieces, &c., the whole of the exposed parts of dormers and turrets, hospital floors, fascias for shop fronts, &c. When of good quality it bears the alternations of the weather very well.

Large members may be built up in sections with advantage, as described for oak. Teak may be thus described:—

Description of Teak.—"The teak shall be Burmese, out of plank, of the best quality, thoroughly dry, well seasoned, free from shakes, stains, dead knots, or other defects, and matched in colour and grain."

American Whitewood.

Treatment of Whitewood.—This is sometimes called Canary whitewood, frequently used for internal fittings of dwelling-houses, and for shop and public-house fittings. When stained and French polished it has the appearance of much more expensive and harder wood. It may be thus described:—

Description of Whitewood.—"The whitewood shall be dry and well seasoned, of the best quality <M> brand, free from sap, shakes, and all defects, to be finished with the plane without sandpaper, and to be secretly fixed in the best manner."

American Walnut.

Ordinary Uses for American Walnut.—This wood is frequently used for internal joinery, and for shop fronts, generally polished.

Large members should be built up in sections, as suggested for oak. It may be thus described:—

Specification of Walnut.—"The American walnut shall be out of the best quality of plank of <K> brand, dry, well seasoned, of good figure, to be matched for colour and grain, and free from stains, shakes, and all defects, to be finished with the plane without sandpaper, secretly fixed in the best manner, and kept clean for polishing."

Sequoia (sometimes called Canadian Redwood).

Ordinary Uses for Sequoia.—This wood is frequently used for internal joinery as a substitute for harder and more expensive woods. It is usually polished. It may be thus described:—

Specification of Sequoia.—"The Sequoia shall be wood of the best quality, dry, well seasoned, of good figure, to be matched for colour and grain, free from stains, shakes, sapwood, and all defects, to be finished with the plane without sandpaper, secretly fixed in the best manner, and kept clean for polishing."

FOUNDER AND SMITH.

Quality of Iron.—The specification of the trade should begin with a description of the quality. In ordinary cases it goes no further than that "all the cast and wrought iron shall be of the best quality."

Sometimes the wrought iron is described thus:—

"All the wrought iron is to be equal in quality to **S. C.** crown iron, all the pieces to be neatly finished to the required shapes and sizes, and securely and accurately bolted and fitted together."

Tests.—If any test is required, state it.

Belgian and English Iron.—Much of the iron and steel work supplied by the iron merchants is Belgian. If English manufacture is required it must be so described.

Holes and Bolts.—Any special kind of work must be clearly stated, such as holes drilled instead of punched, turned bolts instead of ordinary forged bolts, &c.

Small Iron Articles.—Small iron articles like corbels, gratings, hinges, &c., should have their weight stated.

Rolled Joists.—State the position, length, span, and weight per foot run of every joist or girder.

Cambering Joists or Girders.—If joists or girders in floors are of 20 ft. span or over, cambering them is a wise precaution, and well worth the extra 7*s.* or 8*s.* per ton which it will cost. Describe thus:—

"All steel joists or girders of floors 20 ft. span or over shall be cambered $\frac{3}{4}$ in. in 20 ft."

The simplest way of specifying joists and girders, if the quantity is moderate, is as follows:—

"The lengths of the girders and joists are believed to be

correct, but the contractor is to be responsible for their accuracy."

"Supply and fix in positions, and of sizes and weight as follows, rolled iron joists of the best manufacture :—

"To support wall east of the best w.c., ground floor, two joists 3 in. by $4\frac{7}{8}$ in., weight 13 lbs. per foot run, and 8 ft. 6 in. long.

"To support the main wall over larder and knives two joists $9\frac{1}{2}$ in. by $4\frac{1}{2}$ in., weight 29 lbs. per foot run, and 17 ft. 6 in. long.

"To support wall over kitchen bay, two joists $9\frac{1}{4}$ in. by $3\frac{3}{4}$ in., weight 24 lbs. per foot run, and 10 ft. long," &c.

Selection of Joists from Trade Lists.—The usual course is to select from an iron manufacturers' list the section of joist of sufficient strength to support the weight. It is better to take a heavier section than the list prescribes than a lighter one.

Tables of Ironwork.—In cases where there is a large quantity of structural ironwork a table like the following is often the most convenient way of specifying it :—

Position.	No.	Length		Weight per ft. run.	Size.	Connections.
		ft.	in.	lb.	ft. in.	
Supporting western wall, central block . .	1	65	0	172	12 × 14	A
Under north ends of last laid on wall as template	2	5	0	23	$4\frac{1}{2}$ × 5	
On division wall under girder A . . .	1	5	0	23	$4\frac{1}{2}$ × 5	Connected with A by 6 in. length of 3 in. by 3 in. L-iron, riveted on and bolted with $\frac{1}{2}$ in. bolts.
Supporting south wall, superintendent's "w.c."	1	10	0	36	5 × 10	
Supporting south wall, women's private baths.	1	34	9	88	$10\frac{1}{2}$ × 12	
Supporting western wall of tower . . .	2	7	9	16	$6\frac{1}{4}$ × $3\frac{1}{8}$	
To support flat over ground floor, drying closet .	11	7	9	7	4 × $1\frac{3}{4}$	
To support cistern in tower	2	8	6	11	$6\frac{1}{4}$ × 2	Kept above floor for access to bottom of cistern.
Girders of floor of women's private bath . .	2	17	6	42	12 × 5	B
	2	18	8	42	12 × 5	
Joists of last floor . .	5	11	0	11	$6\frac{1}{4}$ × 2	Each secured to girders B by a 6 in. length of 3 in. by 3 in. L-iron riveted to a web of girder, and bolted with $\frac{1}{2}$ in. bolt to joist.
	10	11	6	11	$6\frac{1}{4}$ × 2	
	5	8	2	11	$6\frac{1}{4}$ × 2	
	5	8	8	11	$6\frac{1}{4}$ × 2	
	4	7	3	11	$6\frac{1}{4}$ × 2	
Trimmer for steps ditto .	1	4	0	11	$6\frac{1}{4}$ × 2	Ends forged and fitted to transverse joist of similar section, secured by 4 in. length of 2 in. by 2 in. angle iron, riveted to web of one joist, and bolted with $\frac{1}{2}$ in. bolt to the other.

Specification of Structural Iron or Steel Work and Alternatives.—Another way suitable to large works is to begin the trade with a description of quality and workmanship, and refer to the details for the sizes, thus :—

"The whole of the joists and girders to be of the sizes shown and figured on the drawings." See that all the sizes are marked on the drawings.

An alternative to the practice of marking the sizes on the general drawings is the preparation of a plan of the ironwork of every floor (Fig. 109), marking the sizes of all the rolled joists of ordinary section, and marking each type of riveted or combination girder with a number and a note. See Detail. These

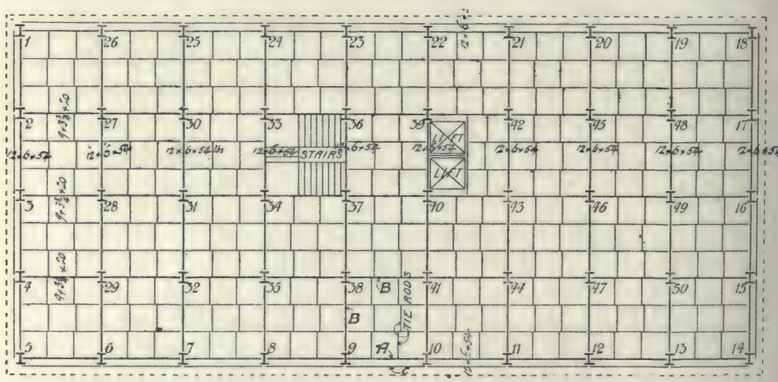


FIG. 109.

numbers will refer to a special detail to a larger size, marked Detail of girder "No. 20," or as the case may be.

"The structural ironwork (or steel work) to be as shown on the ironwork plans and Details numbered 10, 11, 12, 24, 25, 26," &c.

A modification of the last method is to distinguish each floor by a letter (Fig. 110), as A B C, &c., writing a table similar to the former one, but substituting for the description in the first column a letter and a number, as A^1, A^2, B^1, B^2, &c., referring to a plan of the joists and girders of each floor, each joist and girder on such plan being marked with a corresponding letter and number.

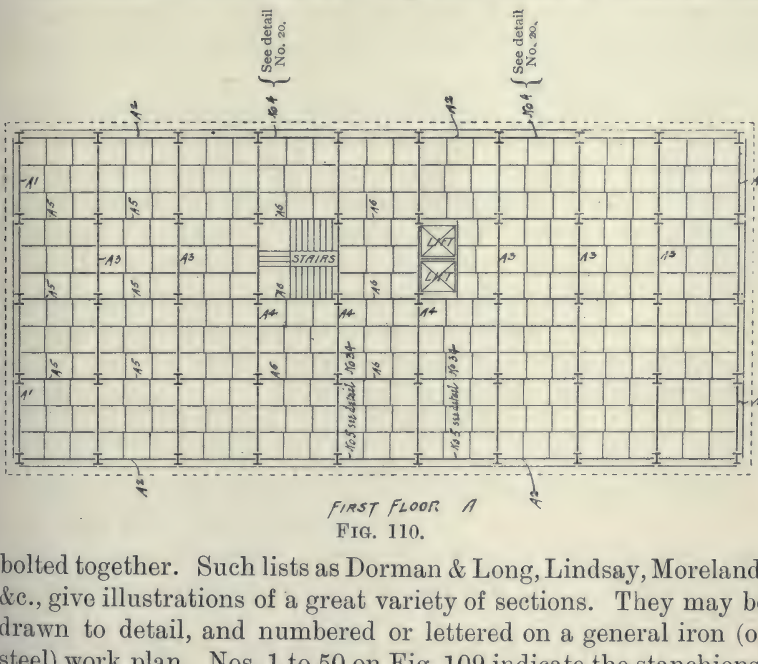
Either of the foregoing methods may be adopted, although the structural ironwork may be made a separate contract.

Table of Weights on Girders and Stanchions.—Some of the American specifications include tables of the weights on each

girder, column, stanchion, or foundation pier; but although the preservation of all calculations in a systematic way is an admirable practice, their inclusion in a contract document is not likely to be adopted by English architects, and it is difficult to see what it has to do with a specification.

Large Riveted Girders.—When girders are large, and built up of boiler plate, with angle-iron stiffeners, covering pieces, &c., they are difficult to describe lucidly in detail. In such case a drawing of each floor and each girder should always be made and referred to.

Stanchions.—Stanchions are very often made of steel sections



FIRST FLOOR A

FIG. 110.

bolted together. Such lists as Dorman & Long, Lindsay, Moreland, &c., give illustrations of a great variety of sections. They may be drawn to detail, and numbered or lettered on a general iron (or steel) work plan. Nos. 1 to 50 on Fig. 109 indicate the stanchions.

The American specification sometimes includes a tabulated list of the dead loads, live loads, and column loads on every floor. Factors of safety are also mentioned. This practice may possibly be caused by the requirements of the building law of American cities, but it is not within the reasonable scope of a specification. Tables of the kind should certainly be made and carefully checked, but they are not, as a rule, a contractor's affair.

Their mode of construction is shown in a paper read before the Institution of Civil Engineers, "Steel Skeleton Construction in Chicago" ("Minutes of Proceedings," Vol. 128).

Felt Pads.—State their size, and kind of felt; if boiler felt, the number of ounces per foot. For the size, adopt a generalisation like that recommended for templates.

Lead Pads.—State size and weight per foot superficial.

Iron Roof Trusses.—These are generally most conveniently described by reference to the detail drawings; they may form part of a separate contract for ironwork.

Small Articles.—Follow with small wrought-iron articles not connected with any other trade.

Iron Staircases, Pavement Lights, Stall-board Lights.—As any of these will certainly be supplied by a maker of such things, it is best to select from a trade list or manufacturer's stock, and a sum may be provided.

Iron staircases are illustrated in the following trade lists (among others) :—St. Pancras Ironworks Co., Haywood Bros. & Eckstein, Macfarlane, &c.

Pavement lights are illustrated in great variety in the following trade lists :—Haywood Bros. & Eckstein, Hyatt, The St. Pancras Ironworks Co.

Steel or Wrought-iron Sashes.—Describe the size and section of bar, if with wrought bosses, how fixed, the parts which shall open, how hinged, the kind of stays and fastenings, and whether these accessories shall be of iron or gun-metal.

The opening parts may be marked with a uniform sign on the elevations, as **X.** or **O.**

Balustrades.—State size of rail, and whether flat, half-round, oval, convex. Describe size of bars, if square, as "1 in. by 1 in.," &c.; if round, "1 in. diameter." State whether run with lead or cement. Describe such ends as are caulked or forged as scrolls or newel caps.

The wrought-iron rail may be combined with cast-iron ornamental balusters or baluster panels. These are most conveniently described by numbers from a trade list (or P. C.). They may be described as follows :—

"Construct the balustrade of the staircase from ground to first floor of $2\frac{1}{4}$ in. by $\frac{5}{8}$ in. wrought-iron oval handrail, ramped and wreathed as described, and with 3 in. by $\frac{5}{8}$ in. newel cap. Put $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. wrought-iron octagonal newel, riveted to the handrail, and passing through the bottom step with screw end and nut. Supply for each step a cast-iron ornamental baluster panel, P. C. 10*s.* at manufactory, riveted at top to

the handrail, and at bottom let into the step and run with lead."

Iron Railings.—The sizes of the parts should be stated as rails and bars; the sizes of bars and stays as stiffeners at intervals. A few of the ordinary stipulations are as follows :—

"The holes through the horizontal rails of balustrades shall be punched while hot."

"All horizontal rails to be wedged with steel double wedges to the standards."

"When the vertical railings and intermediate standards pass through the horizontal rails, the latter are to be tightly caulked, and a small wrought-iron pin is to pass through the intermediate standards immediately under each horizontal rail, and the pin is to be riveted over at each end."

"The ordinary bars of the railings shall have mortises 2 in. deep, the remainder 4 in. deep into the curb, and the bars shall be jagged" (as Fig. 111).

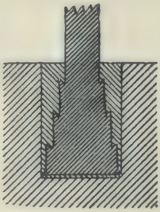


FIG. 111.

Handrail brackets.—These, if not of a trade shape, should be sketched and described, and the definition is more precise if the weight be given. If selected from a trade list, state number and maker's name.

Guard Bars.—Describe sizes of rails and bars, and how fixed, and whether ends are pointed or countersunk and screwed, or caulked and built into wall. If bars are more than 4 ft. high, they should have an intermediate rail.

Core Rails.—Describe size and how fixed. Where used with iron balusters state that the iron balusters are riveted to it. A core rail is useful to strengthen the wooden balustrade of a wooden geometrical staircase.

Isolated Balusters.—Iron balusters are sometimes used at intervals of about 5 ft. to strengthen the balustrade of a geometrical staircase with wooden balusters, and are thus described :—

"Supply, and fix about 5 ft. apart, 1 in. by 1 in. wrought-iron balusters to match the wooden ones, riveted to core rail, each with a flange 1 in. by $\frac{3}{4}$ in. and 6 in. long, let in flush with the tread of the step, and screwed with three screws with countersunk heads."

Iron Strengthening Bar to String.—The outer string of a geometrical staircase may be strengthened by an iron bar.

"Fix to the inside of the outer string, immediately under the steps, with screws about 9 in. apart, a 3 in. by ½ in. wrought-iron bar, accurately forged to fit the plan of the string, and wreathed as required; secure it also, where possible, to trimmers and newels."

Galvanizing.—All articles are to be galvanized after they are made, and shall weigh not less than the specified weight before galvanizing.

Provision of Material.—Sometimes a provision of material is made here, or a similar clause may be written at the end of "Carpenter."

"Provide 5 cwt. of wrought iron in straps and bolts and fixing to roofs, to be used as directed, or deducted if not required."

Cast-iron Columns.—Structural work in cast iron consists mostly of columns or stanchions.

Columns.—Specify the height and diameter of the column; state thickness of cap and base, and how attached to base and to work above. If hollow, state thickness of metal, and all as last; and make clear whether external or internal diameter is meant, thus:—

"The two iron columns on ground floor to be hollow, of 1 in. metal, and 8 in. external diameter, with plain caps and bases, 12. by 12 in., the bases to have two 1 in. by 1 in. stubs, and the caps to have 1 in. brackets, four to each column. Bolt each cap to the girder above with two 4 in. by ½ in. coach screws."

Stanchions.—Specify height, thickness of metal, size each way, how many stiffeners, and draw section thus I, or as the case may be. Describe thus:—

The stanchions to front to be 12 in. by 8 in., of 1¼ in. metal of I section, with square caps and bases, with two stubs to base, let into the stone base, and each of the caps secured to girder above by two ¾ in. bolts 4 in. long, with heads and nuts.

An alternative is to describe the foregoing as weighing a certain weight each; or they may form a part of a separate contract for ironwork.

Cast iron may also be tabulated in some such manner as follows:—

Position.	Length.		Weight each.			Size.	No.
	ft.	in.	cwt.	qr.	lb.		
Under laundry	14	0	12	0	0	9 in. diam. 1¼ in. metal . .	3
Under tank .	7	0	2	2	0	6 in. diam. ¾ in. metal . .	3

Columns.

General Plan showing Columns or Stanchions.—A plan of the ironwork of each floor, as before described, may be used to indicate the positions of columns and stanchions, each numbered with a consecutive number and referred to a special detail, and for the description in the first column of the table substitute a number corresponding with that on the plan.

Either of the foregoing methods may be adopted, although the structural ironwork may be made a part of the contract.

Rain-water Pipes.—Specify diameter, and how fixed. Refer to them "as in the positions shown on drawings," and draw them on plans and elevations. If not shown on drawings, the description is often long and troublesome.

If ornamental, or square, describe them by number from a trade list, state name of manufacturer, and if heavy or extra heavy.

Specify loose ears or ornamental spikes by number from a trade list.

"The rain-water pipes to be 3 in. round with ears, cast on and fixed with rose-headed nails to plugs in the brickwork. Supply all requisite swan necks, plinth bends, elbows, &c. Put at foot of each stack of rain-water pipes a shoe to discharge over a gulley as described in drains."

"The rain-water pipes to be Macfarlane's Glasgow 4 in. by 3 in. with loose ears, No. 28, fixed with wrought-iron nails with ornamental heads to oak plugs in the brickwork, all to discharge with shoes over surface gulleys as described in drains."

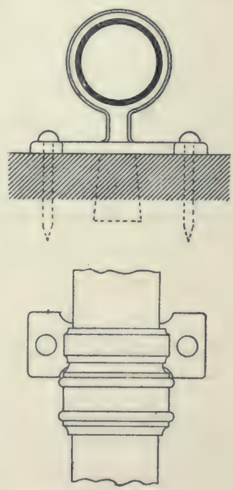


Fig. 112.

"Supply the necessary elbows, swan necks, plinth bends," &c.

"Fix where directed two Macfarlane's heads. List price, 12*s*. each."

If it is considered desirable to fix the rain-water pipes away from the face of the walls, bands and ears, or "holderbats," as they are sometimes called, may be used, illustrated in Fig. 112 and Fig. 113, the trade list of Stevens Bros. They may be described by a number in the trade list, or wrought-iron ones

may be used. In either case there would be no ears cast on the pipe, or a pipe with ears cast on may be blocked out by short lengths of iron barrel, in which case longer nails than usual would be required. Describe as follows:—

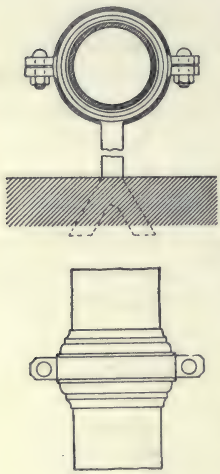


FIG. 113.

"The rain-water pipes to be 3 in. round rain-water pipes, without ears, fixed with Stevens Bros.' (Upper Thames Street) No. 70 bands and ears."

Or,

"The rain-water pipes shall be 3 in. round rain-water pipes, without ears, fixed 2 in. from the wall with $\frac{3}{4}$ in. by $\frac{3}{8}$ in. wrought-iron clips bolted together with $\frac{1}{2}$ in. bolts with 1 in. by 1 in. stems, split, and built 3 in. into the wall as sketch."

Or,

"The rain-water pipes shall be 3 in. round rain-water pipes with ears cast on, blocked out $1\frac{1}{2}$ in. from the wall by short lengths of $\frac{1}{2}$ in. galvanized iron barrel, nailed through the barrel with 4 in. wrought-iron nails with rose heads to teak plugs in the brickwork."

Joints of Rain-water Pipes.—Sometimes the joints of rain-water pipes are caulked with tow and red lead.

"The joints of the rain-water pipes shall be caulked with red lead and tow, the sockets completely filled."

Eaves Gutters.—Specify size, and how jointed and fixed, and if ornamental, whether heavy or extra heavy, and describe them by number from a trade list.

The distinctions are "half round," "ogee," "ornamental." For the half-round gutters, state size, and the nature of the brackets.

"Supply for eaves of all outhouses 4 in. half-round gutter, jointed in red lead cement, and fixed with wrought-iron brackets of $1\frac{1}{2}$ in. by $\frac{1}{2}$ in. iron 12 in. long, and each screwed with three screws to the backs of rafters. Supply all necessary stopped ends, angles, outlets," &c.

Various shapes of gutter brackets are illustrated in the trade lists of ironmongery.

"Supply for all eaves of the main building Macfarlane's (Glasgow) $4\frac{1}{2}$ in. by $3\frac{1}{2}$ in. No 12 moulded eaves gutter, bolted

and jointed with red lead cement, and fixed with stout screws to the fascias. Supply all necessary stopped ends, angles, outlets," &c.

Special Outlets to Eaves Gutters.—Sometimes, to avoid the use of swan necks, purpose-made outlets on the back of the gutter are used.

"The outlets to be specially cast on the back of the eaves gutter with small quadrant bend to connect with the rain-water pipe."

Iron Doors in Party Walls.—The division of buildings, the cubic contents of which exceed that allowed by the London Building Act, is often most conveniently done by using iron doors as prescribed by section 77. The following meets the requirement:—

In the Mason.—"Put step to each set of iron doors in party wall of 4 in. York, finely tooled on all exposed faces, and 4 in. wider than the thickness of the wall."

In the Founder and Smith.—"Fit each opening in the party wall with wrought-iron doors, two pairs to each opening of $\frac{1}{4}$ in. plate iron, with $1\frac{1}{4}$ in. by 4 in. stiles and rails in 8 panels, each set all riveted together, and each leaf hung with three 4 in. wrought-iron butts riveted on, and to $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. L iron frame, with $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. lugs, double-fanged, tapped and screwed in about 2 ft. apart, and built into the walls. Fit each pair of doors with four 12 in. best barrel bolts, and four 6 in. strong wrought-iron bow handles all riveted on."

Or,

A sum may be provided. Hobbs & Co. give illustrations and prices in their trade list.

Iron Doors to Safes.—For these it is the general usage to provide a sum. The trade lists of Hobbs and Chubb illustrate these, and state prices and sizes, and the trade description should be adopted. A stone sill and lintel to the opening makes the best finish, and both they and the brickwork of the jambs should be rebated to receive the frame.

Bricklayer.—"Rebate the jambs of the safe doorway to receive the frame of iron door. Cut and pin the lugs into the brickwork and fix the door."

Mason.—"Fit the doorway of safe with 9 in. by 4 in. finely tooled lintel, &c., sill 18 in. longer than the width of opening and rebated to receive the frame."

Smith.—"Supply for butler's safe Chubb's (128, Queen Victoria Street) iron door, No. 4, 6 ft. 2 in. by 2 ft. 8 in., outer plates $\frac{5}{8}$ in.

thick. List price, £31." Safes of banks are sometimes fitted with an iron grill as well as a fire-proof door.

Bostwick Gates.—For these a sum is usually provided. Their great recommendation is the small space they occupy when not in use. Various applications of the gate are illustrated in the trade list of the Bostwick Gate and Shutter Co. (Baldwin's Gardens, London). Either a recess or a projecting pier is required in an opening, so that they may fold out of the way.

Iron Roof Trusses.—These are most conveniently described by reference to a detail drawing, in which case a general description only of their construction would be sufficient, thus:—

"The iron-roof trusses over the gymnasium to be constructed in the best manner to detail drawing, No. 24, all to be of wrought iron except the shoes on the walls, which shall be cast."

They may be made part of a separate contract for structural ironwork.

Tables of the sizes of the parts are to be found in Molesworth's "Pocket-book of Engineering Formulæ," or Hurst's "Architectural Surveyor's Handbook." For the orthodox connections, see Vol. I., "Notes on Building Construction" (Longmans).

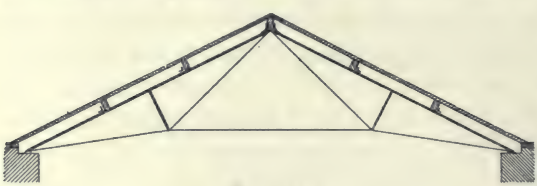


FIG. 114.

The simplicity of such roofs as the foregoing is one reason for their use, one set of supports being, as a rule,

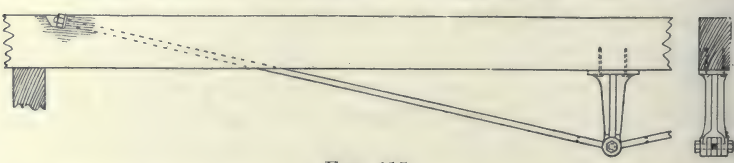


FIG. 115.

omitted, the rafters increased in size and disposed as purlins (as Fig. 114).

Iron Trussing to Beams or Purlins.—"Strengthen the purlins over the central bay of the loft (Fig. 115) by 1 in. wrought-iron rods. Forge the extreme ends of the rods, and fit them with large nuts and washers. Supply a cast-iron strut, weight 21 lbs., and fix it to the purlins with two $\frac{1}{2}$ in. by 4 in. coach bolts, and connect it to the rods by a $\frac{3}{4}$ in. bolt."

Iron Letters.—Cast-iron letters are sometimes used for shop

fascias on walls of manufactories, &c. State the name of maker, the height of the letter, and the number in the trade catalogue. They may be fixed with screws to wooden fascias, to wooden plugs in brickwork, or to lead plugs in stonework.

Supply and fix lead plugs in the stone frieze Macfarlane's (Glasgow) No. 1 iron letters and numerals 12 in. high, with two stops, to form inscription, "Smith's Repository, 1899."

Wooden Letters.—Wooden letters are used for similar purposes to those of the iron ones, and may be fixed in a similar manner. Sometimes it is reasonable to fix them a little distance from the wall face. Specify thus :—

"Supply and fix, about 3 in. apart, sound dry cross-tongued pine letters $1\frac{1}{2}$ in. thick and 21 in. high, of the character known as "heavy Roman," with bevelled edges and two stops, to form the inscription, "Smith's Repository, 1899." Fix each letter with two $2\frac{1}{4}$ in. screws for the smaller letters and stops and four for the larger, the screws to have their heads countersunk, and to be screwed to a tapped hole in iron rail. Fix them to two rows of 1 in. by $\frac{1}{2}$ in. wrought-iron rail (Fig. 116), each rail supported 4 in. from the wall by $\frac{1}{2}$ in. by $\frac{1}{2}$ in. wrought-iron riveted and framed brackets, as sketch, 4 in. projection and 4 in. high, with lugs caulked and built into the wall, riveted to the rails, and 3 ft. apart."

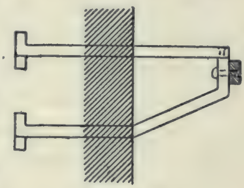


FIG. 116.

Iron Railing.—"Construct the railing, 5 ft. in height, from coping to tops of wrought-iron of 1 in. by 1 in. bars with pointed tops, the standards and stays to be $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. with tops to match the bars. The ends of the bars, standards, and stays to be jagged, mortised into the stone curb $1\frac{1}{2}$ in. and run with lead, the rail to be 2 in. by $\frac{5}{8}$ in., enlarged as sketch, for passage of standards, so as to give 1 in. in width beyond the standards all around." (Fig. 117.)

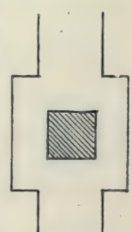


FIG. 117.

Iron Gates.—"In two places, as shown on block plan, supply a pair of gates to match the railings 4 ft. 6 in. wide of stiles $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in., and three rails 2 in. by $\frac{5}{8}$ in., the outer standard of each gate to be turned at bottom as pivot to work in a wrought-iron cup let into the threshold and run with lead, the top of the standard to be also turned and fitted with a 2 in. by $\frac{5}{8}$ in. strap 20 in. long as socket bolted with $\frac{1}{2}$ in. bolt to the fence standard

(as Fig. 118). The rails to be increased in size for the standards, as described for railing."

FIG. 118.

"Fit one of each pair of gates with $\frac{3}{4}$ in. by $\frac{3}{4}$ in. wrought-iron bolts 27 in. long, with wrought-iron slotted eye and two bands riveted to the standards, and wrought-iron thimble let into the threshold and run with lead."

"On one standard of each pair of gates rivet a $\frac{3}{4}$ in. wrought-iron plate 3 in. by 3 in. with perforation as eye."

"Fit each pair of gates with a padlock. P. C. 5*s.*"

Ornamental Iron Gates.—Ornamental iron gates may be either of the stock patterns which are to be found in the trade list, or they may be of wrought iron to special design. The gates in either case may be a provision, and all the necessary adjuncts should be described. The following is an example:—

"Provide for one pair of iron gates to north western entrance, P. C. £200, and fix them."

"Supply an approved patent gate stop, P. C. 20*s.*, let into a tooled York stone 14 in. by 14 in. by 18 in., and run with lead. Sink the stone flush with the roadway. Supply four Ancaster stone hinge stones of the size of the plan of the gate piers 12 in. high, and rubbed in all exposed faces."

"Attend on ironworker in all trades to the fixing of these gates."

Area Grating.—State the size of the frame of the bars and their distance apart, how fixed, as with lugs, and how many.

The city of London has a standing order as to street gratings, their length and projection from the front of the building, the size and distance apart of the bars, &c.

Many of the local governing bodies have made similar regulations.

"Construct the grating to western area of basement of wrought iron $\frac{1}{2}$ in. by $1\frac{1}{2}$ in. frame, and $1\frac{1}{2}$ in. by $\frac{3}{8}$ in. bars about $2\frac{1}{2}$ in. apart, the frame prolonged to form a lug at each angle 4 in. long, which shall be let in flush to the curb and run with lead."

Cranes and Crabs.—For these it is best to obtain an estimate from a maker, who should furnish a specification and a drawing with his estimate. The maker should fix it, the general contractor supplying the necessary attendance.

The maker should guarantee the lifting of a certain weight, as 10 cwt., a ton, or as the requirement may be, and should test its capability to the architect's satisfaction and in his presence.

As much of the stress will come upon the crab, provision should be made by a girder or some similar means to meet it. The pier which receives the step and the bolts should be built in cement.

Or,

Both cranes and crabs may be selected from an engineer's trade list (such as Tangyes) by a number.

Stoves.

These are nearly always treated as a provision or specified by number from a trade list, and this should be referred to, and as much of the description adopted as may clearly define the intention, thus:—

"Supply for bedrooms Nos. 4 and 5 Boyd's (Hendry & Pattisson, Marlborough Mews, Oxford Street) "Rawdon" college grate B pattern No. 2, with three fire lumps above the basket, and twelve Minton's 6 in. by 6 in. best ivory white tiles to the jambs."

Slow Combustion Stoves.—Register stoves are now seldom used by architects. The slow combustion stove with tiles around is more in accordance with modern taste.

Provisions for Fireplaces.—The specification should clearly express what the provision for a particular fireplace includes, as P. C. of stove, tiles, how much each and how many rows, hearths, the kind of tiles, how much per yard, or how much each, the P. C. of curb, &c.

Setting Stoves.—Sometimes the person who supplies the stoves will set the stove, tiles, hearth, and curb. In such case the general contractor supplies the materials for setting, and prepares the cement screeds for the vertical tiling and the hearth. As to this, the specification must clearly show the architect's intention, thus:—

"The merchant who supplies the stoves will deliver them at the building, set them, the hearths, and the curbs. Contractor shall supply all the necessary materials, shall prepare the concrete, and cement screeds to receive them, and make good all work afterwards."

Dog Stoves.—The recesses of fireplaces for dog stoves should be lined with tiles or glazed bricks, and should be either arched over or covered with a stone slab with an opening in it, fitted with an iron register door, and the flue should be contracted to its ordinary size immediately above such opening to prevent the deposit of soot.

"Cover the recess of fireplace in hall with a 4 in. rubbed York landing in one stone, resting not less than 4 in. on the brickwork on three sides, and carefully jointed to the back of the arch in front. Cut and rebate a hole through it, and bed therein an approved register door and frame. P. C. 12*s*. The flue shall commence at its normal size immediately above the slab."

Combined Stove and Chimney Piece.—Combined stoves and chimney pieces all of iron are sometimes used in inferior rooms. The trade lists show illustrations of them in great variety.

Ventilating Stoves.—There are stoves by various manufacturers which are set with a chamber behind them, with an inlet for the outer air, which, being warmed, is admitted to the room by a grating and regulator over the stove. Boyd's hygiastic stove is of this type. They are suitable for schools or class-rooms.

Hob Grates.—The various kinds of hob grates, of which the fashion has revived, must have the backs and jambs of the opening above the stove lined with glazed bricks, glazed tiles, or cement. The top must be an iron register, or it may be treated as suggested for a dog stove.

In such rooms as servants' halls, pantries, housekeepers' rooms, attendants' rooms, in public buildings, &c., hob grates are often used.

Mounting of Tiles for Fireplaces.—Tiles around stoves are very liable to detachment. Their enclosure by an iron frame, or mounting them on a slab of slate, is a reasonable precaution, but it must be specified.

Ranges.—Of ranges, the variety in the market is very great. A provisional sum is most convenient. Illustrations abound in the trade lists. The architect will decide as to the kind he wants, as open fire, close fire, or a combination of the two, also whether he prefers iron covings, or glazed brick or tile above the ironwork. If the boiler is to supply a hot-water system he must decide upon that, and that it presents plenty of surface to the fire so as to ensure rapidity of heating. Observe that it is possible to have a boiler too large for usefulness.

It is expedient before specifying a range to see an illustration of it in a trade list and adopt the trade description. The mere name, as "Eagle," or "Phœnix," or the like, is not sufficient.

"Supply in kitchen an 'Eagle' range (Eagle Range & Foundry Co., 58, St. Paul's Churchyard), No. 17, 5 ft. wide, 5 ft. 9 in. high, with regulating firebox, two wrought-iron ovens, cast panelled coving plates, covering-in plate, and cleaning door, top

and bottom heating flues to ovens with reversing damper, cinder sifter, bright ornamental bracket shelves under oven doors, polished mouldings, best finished lever latches with non-conducting handles, cleaning scraper, hooks, and wrought-iron bath boiler. List price, £4 10*s*."

The ranges known as "self-setting," "portable," &c., will have the fireplace either rendered with cement, lined with glazed tiles or glazed bricks.

Cooking Apparatus for very Large Establishments.—For the fitting up of the kitchens of a large establishment like a club, hospital, college, workhouse, or barrack, the architect usually obtains a separate tender from a person accustomed to work of the kind, and this is generally the best way. If he knows exactly what he requires he may get prices from several men of equal position in the trade, and so obtain some of the advantages of competition. Each manufacturer should clearly specify and draw what he proposes to do, should do all the setting and fixing of the apparatus, and guarantee its efficiency.

In such buildings a steam-engine and boilers would probably exist, and steam would be used in at least a part of the cooking.

Hot Closets.—Hot closets may be fixed over a range, and would be supplied by a range maker. They are best treated as a P. C. sum with the range. Gas hot closets may be dealt with in a similar way, but the gas must be laid on.

Gas Hot Plates.—Are most conveniently arranged as a provision. They may be selected from a trade list. A stone hearth, a hood, and supply of gas are the requirements beyond the P. C. Describe thus :—

"Supply a gas hot plate 5 ft. 9 in. long, 2 ft. 6 in. wide, 2 ft. 8 in. high. (P. C. —— at manufactory.) Lay on the gas with ¾ in. pipe from nearest supply of not less than equal size, and supply ¾ in. brass stop-cock and unions."

Iron Hood.—"Supply for hot plate an iron hood of No. , B. W. G. sheet iron riveted to 2½ in. by 2½ in. L steel frame, pinned into wall, and supported by two framed brackets of similar L steel. The area of the plan of the hood shall extend 2 in. each way beyond this plan of the hot plate. Form opening into the flue provided, and fix therein a 9 in. cast-iron ornamental air brick, and render the opening with cement."

Electric Lift.—"Supply a power lift capable of raising 15 cwt. from the basement to the top floor, the cage 6 ft. wide, 5 ft. deep, and 8 ft. high, of strong angle iron framing with 1½ in. sides and

2 in. bottom, all wrought and cross-tongued, and with wrought timber guides. Fit with gear, including one fast and two loose pulleys, on the worm shaft, with worm cut out of the solid, and running in coned-thrust bearings with steel wire rope and large drum turned and grooved to suit the rope.

"Fit brake on the worm shaft to act automatically by the striking gear. Supply the steel girders necessary for mounting the whole.

"Fit the cage with safety apparatus, balance weight, and guides, top wheels with spindles, bearings, and girders, with steel wire ropes for support and starting, the latter with automatic stop at top and bottom. Supply countershaft and hangers, bearings and pulleys in the basement, and all engineer's work throughout, exclusive of electro-motor and driving belts between the motor and the lift.

"All materials, fittings, and labour to be of the best quality and description, and to be left in perfect working order, and contractor shall give a guarantee of its successful working for two years."

GASFITTER.

Gasfitting often a Provision.—This work is so subject to variation that it is frequently treated as a provision. A calculation is made of the approximate quantity of pipe required and inserted as follows :—

Provide the following lengths of pipe and fixing :—

400 ft. ½ in. pipe.
60 ft. ¾ in. ,,
70 ft. 1 in. ,,

Materials.—Describe the kind of pipes, and whether galvanized or painted. State position of gas-meter, diameter of rising main, and how far it retains that diameter, and sizes of branch pipes. If the brackets are marked on the plans there is less liability of claims for variations. The diameter of branch pipes is sometimes defined in the following manner :—

"The pipes to be of the following diameters—to supply two lights, ¼ in. diameter ; six lights, ⅜ in. diameter ; twelve lights, ½ in. diameter."

Fittings.—May either be treated as a total provision for fittings and fixing, or the fittings alone may be a provision, and the fixing enumerated. If fittings are made up of gas-barrel, their size should be specified, the kind of burners, and the fixing.

Describe thus: "Supply in printing office six two-light Tee pendants, each containing ten feet of $\frac{3}{4}$ in. barrel, one $\frac{3}{4}$ in. Tee piece, two strong brass elbow cocks, and two Bray's burners. Connect each pendant with the supply by a Tee piece."

The numbers in the trade list of a manufacturer of gasfittings may often be conveniently adopted for the description of brackets, pendants, &c. See page 108.

Connection with Main, &c.—Specify connection of main and meter (lead pipe and brass connection), and gas-main cock.

Meter.—If in contract, specify the capacity of gas-meter by number of lights (always less than the actual number), and give maker's name and price, if possible.

A gas-meter is generally hired from the gas company, but there is nothing to prevent its being the property of the building owner.

Describe thus: "Supply a sixty-light Glover's dry gas-meter, pay for stamping by the gas company, and for carriage to their office and to the building, and fix it."

Attendance, &c.—Describe attendances, testing of pipes.

Separate Supplies.—Separate supplies are sometimes required to various parts of a building, as to dormitories, each supply fitted with a regulator to turn the gas down.

Bye-pass.—In churches the separate supplies may each have a stop cock and bye-pass, or a regulator.

BELLHANGER.

Materials.—Describe the average weight of the bells, and how hung. Specify them floor by floor, thus:—

Supply the following bells and pulls:

Bell (First Floor).—Bedroom 5. One bell with two pulls to ring in kitchen.

Bedroom 6. One bell with one pull to ring on third floor, landing, &c.

Pulls.—Describe the pulls by number and price in trade list, and specify fixing, or say here "a sum provided for pulls," and insert a sum in list of provisions.

Bell Board.—Specify thickness for how many bells, and how fixed, and specify a written number for each bell.

ELECTRIC BELLS.

Materials.—Describe the wires by B. W. G., how insulated, how covered, the kind of roses to buttons, the backs, the springs, the contacts, the bells and indicators, the battery.

Supply and fix an indicator wherever a bell is connected with more than one push.

PLASTERER.

Materials.—Describe the lime, and state where made, the sand, laths, hair, and the proportion to be used, how long the putty shall be run before use, the cement of various kinds, and the nature of its backing.

Lathing.—If the work is to be of fairly good quality lath and half should be specified.

Metal Lathing.—Various kinds are obtainable, as Edward's patent iron lathing, Johnson's patent rolled wire lathing, expanded metal, Jhilmil patent metal lathing, &c. They should be fixed with galvanized iron nails.

Sand.—The sand should be sharp, and should be washed if used for cement work.

Lime.—Lime for plastering should always be run into putty at least a month before use.

Selenitic Plastering.—If selenitic cement be used for the plastering a clause should appear.

"The lime shall be selenitic, and used in accordance with the company's printed instructions."

The company issues instructions. It is maintained by some architects that selenitic plastering is not satisfactory when used on lath, as for ceilings and partitions, and they consequently prescribe in the same building selenitic plastering on the brick-work, and ordinary plastering on the lathing. The use of two kinds of plastering in the same building, and often in the same room, increases the expense, and involves closer supervision.

Hair.—The proportion of hair in the coarse stuff is not often specified. If it is, about 10 lbs. of hair to each cubic yard of coarse stuff is sufficient. When a ceiling is of unusual weight, as the moulded ribs to a geometrical ceiling, or heavy enrichments, a larger proportion should be used, or the ceiling will be likely to fall. Specify thus:—

"The coarse stuff for ceilings with coffers or moulded ribs shall be mixed in the following proportions: 2½ yards of sand, 40 bushels of lime, 1 cwt. of hair."

Roman and Medina Cement.—Roman cement is rarely used now, but it is, because of its quick setting, sometimes useful for brick-work in river walls and piers which are below the level of tidal water. If built at low water it will often set before it is again

immersed. Medina cement is used under similar conditions, or for plain faces which are to be painted soon after.

Portland Cement, Description and Quality.—Prescribe the weight per bushel, and the proportion of sand with which it shall be mixed. When the goodness of Portland cement is important it should be tested. Specify the kind of tests, if any. Some of them are as follows:—

"The cement shall be the best Portland, weighing not less than 112 lbs. per bushel, mixed 1 of cement to 3 parts washed sand, and to bear a tensile strain of 600 lbs. on $1\frac{1}{2}$ in. square after being set in water seven days."

Or,

"The cement shall be the best Portland from a maker to be approved by the architect, to weigh not less than 112 lbs. per bushel, or more than 115 lbs."

"Ninety per cent. of the cement shall pass through a sieve of 2,500 meshes to the square inch. Briquettes made of pure cement shall be laid in water seven days, and shall then resist a breaking weight of 350 lbs. per square inch. The architect shall have the power to make tests from any sample of cement on the works, and contractor shall afford facilities for doing so."

Or,

"The cement shall all pass a sieve having 625 holes to the square inch, and leaving not more than 15 per cent. residue. When passed through a sieve having 2,500 holes to the square inch, weight per striked bushel to be not more than 116 lbs. and not less than 112 lbs., to be of cold grey colour, and to bear a tensile strain of 350 lbs. per square inch after seven days' gauging."

Careful tests are, however, best conducted by a specialist, and the necessity is best met by a provisional sum, thus:—

Testing of Cement.—Provide for the testing of Portland cement £10.

To guard against the failure of cement work use the following clause:—

"The cement, as delivered, shall be emptied and spread out on a boarded floor, exposed under cover for a fortnight, and shall be

turned over as frequently as the architect or clerk of works may direct."

Keene's Parian or Martin's Cement.—Sometimes the architect specifies the name of the manufacturer. They may be of fine quality of either kind on a backing of coarse cement of the same kind, or on a backing of Portland. The latter is preferred by the majority.

"The Keene's (Parian or Martin's) cement work shall be mixed 1 part of coarse cement to 2 of washed sand for the backing, with a finishing coat of pure fine quality cement, and very smoothly trowelled for paint."

Some architects say "trowelled to a perfectly true and *polished face*," without any desire for polishing, which is a very expensive process. If it really is wanted, specify thus:—

"The Keene's cement work shall have a backing of 1 part coarse Keene's to 2 parts of washed sand, with a finishing coat of pure cement of the finest quality, thoroughly trowelled, and afterwards highly polished and carefully protected until completion."

Dubbing.—The plastering or replastering of old walls often involves a thick coat of dubbing, as they are uneven, or not perpendicular. Describe thus:—

"Dub out with plain tiles and cement where the walls are uneven, or not perpendicular, so as to produce a truly vertical face for the plastering."

Pugging.—Specify its thickness and composition, and where used. Sometimes it is only used for floors of rooms likely to be noisy, as nurseries, or over such a room as a kitchen, scullery, or servants' hall.

Walls.—State whether render and set, or render, float, and set, and where each shall be used.

Render and set is often specified for economical reasons, but when an architect is employed, the builder rarely makes much difference in the price of two- and three-coat work.

Lath, Plaster, Float, and Set.—State where and whether lath and half shall be used.

Gauged Plastering.—Gauged plastering is sometimes used when the work is hurried. In such cases the proportions of the material should be specified, and whether gauged with plaster-of-Paris or Portland cement.

"The coarse stuff shall be mixed 2 parts sand, 1 part lime,

1 part coarse plaster-of-Paris, and hair in proportion of 10 lbs. to the cubic yard, the setting coat 3 parts lime putty to 1 part of plaster-of-Paris."

Trowelled Stucco.—Trowelled stucco is used in cases where the plastering is to be painted.

Bastard Stucco.—This is the surface commonly used for the walls of churches.

Fibrous Plaster.—This may be used for the plain faces for both walls and ceilings when the work is urgent. They may either be supplied in a finished condition or finished after fixing by the plasterer. Cornices and general moulded work can be obtained of the same material. If they are enriched, a price per foot run is best. There are several well-known manufacturers of fibrous plaster work, from whom it may be obtained. The general contractor never attempts to make it. The plain slabs would be described as follows:—

"Cover the quarter partitions and ceilings with Jackson's (49, Rathbone Place, London) approved well-seasoned fibrous plaster slabs made with a smoothly finished surface, screwed to the timbers with 1¼ in. galvanized iron screws, and carefully stopped with approved patent stopping."

Or,

"Cover the quarter partitions and ceilings with Jackson's (49, Rathbone Place, London) approved well-seasoned fibrous plaster slabs of ordinary surface, screwed to the timbers with 1¼ in. galvanized iron screws, carefully stopped and finished with a thin coat of Keene's cement, trowelled."

If used on walls it may either be nailed with galvanized iron nails driven into the joints of the brickwork, or fixed with galvanized screws to 1 in. by 3 in. deal grounds plugged to the walls.

"Supply in drawing-room Jackson's fibrous plaster enriched cornice. P. C. 5*s*. per foot run at manufactory. Fix it in the best manner, and carefully stop it."

Fine Plaster.—The specification should clearly show whether the girths mentioned are net girths without screeds.

Describe the cornices in the order of their girth, the smallest first, and their position, thus:—

"Run fine plaster cornices moulded 6 in. girth in rooms 1, 2, 3, 12 in. girth in rooms 7, 8, 9, 10, &c."

If there are any wooden cornices, a note may reasonably appear here. "For wooden cornices see Joiner."

Coffered ceilings, ribbed ceilings, eaves, &c., are best described with reference to a detail, thus:—

"Execute the plastering of staircase hall in fine plaster to detail drawing No. 40."

Enrichments.—If enrichments are specially designed, it is necessary to model them; and as it costs no more to see them before they are cast, the architect should do so, or he may provide a sum for modelling. The latter arrangement would involve such clauses as the following:—

"Provide for the modelling of enrichments £10."

"The trusses to the beams in hall and to the ceiling of staircase hall to be cast to detail drawing. For the modelling a sum is provided. See Provisions."

"The cornice of drawing shall have two enrichments 3 in. girth, and one 6 in. wide."

"The cornice of dining-room to have one enrichment 4 in. girth, and one 2 in. girth, &c."

Or,

"All enrichments to cornices, ornamental trusses, &c., to be to detail, and shall include modelling. The contractor shall submit the model of each enrichment before casting it."

Portland Cement Work.—If the work is fairly large it will be convenient to describe the external and internal work in separate sections. State clearly what parts are trowelled. Any parts intended for paint, or such as are subject to much rubbing, must be trowelled.

A uniform tint on the elevations is a convenient way of showing what parts are to be finished in cement, referred to in the specification thus:—

"All the work coloured grey on the elevations to be executed in Portland cement." The mouldings are best described by reference to a detail drawing.

When rustic grooves are intended the thickness of the cement must be clearly stated thus:—

"The thickness of the cement work where rustic grooves occur shall be 1¼ in."

When stiles projecting from the general face are used their thickness should be stated thus:—

"The stiles and rails on southern front shall be not less than ½ in. thicker than the general cement work adjacent."

When rustic quoins are used the extent to which they project should be mentioned, and if moulded the girth of the moulding.

"The rustic quoins to the angles of the building shall be dubbed out with tiles and cement, shall project 1 in. from the general plastering, and shall be moulded 1 in. girth."

Skirtings.—State height, thickness, and, if moulded, the girth of the moulding.

"Run ¾ in. skirting 7 in. high around boot room, servants' w.c., servants' corridor, and scullery."

"Run skirting, moulded 2 in., girth 9 in., total height in garden entrance passage and western porch."

Dadoes.—State where they occur, the nature of their capping and skirting (often a flush bead), and their total height, generally trowelled.

"Run all around kitchen a dado, 6 ft. high in all, well trowelled, with two flush beads 2 in. wide, one 9 in. above floor, the other at top."

Floated Face for Tiles.—Sometimes called screed. It should be used under all tile, wood, and asphalte paving, and as a backing to wall tiling and faïence.

"Float the surface of all concrete ¾ in. thick to receive tiling of pavements and hearths."

"Float the faces of walls ¾ in. thick to receive the tile wall linings."

Mouldings.—State the girth, and where they occur. Flush mouldings are frequently used as cappings to the tiling above pantry shelves and to backs and ends of sinks.

"Finish the top and ends of the tiling around butler's pantry sink with a Portland cement flush moulding 2 in. girth."

Pavings.—Describe their thickness and position, or their position may be shown on the plans by a tint, and referred to in the specification thus:—

"Lay the floors coloured grey on the plans with paving 1½ in. thick, floated and finished in pure cement."

If they fail it is impossible to repair them, and such a clause as the following is commonly used:—

"Should the floor of any apartment prove defective, the whole of it shall be taken up and relaid by the contractor at his own expense."

Cement paving is suitable for basements, areas, sculleries, boot rooms, servants' w.c.'s, wine cellars, and similar positions.

Generally Internally.—The walls of sculleries, of plate safes, a height of 18 in. or 2 ft., to the backs and ends of sinks and the brickwork behind window backs, are often plastered with Portland cement.

Keene's Cement.—Specify the rooms or corridors which are to be finished in Keene's cement, and if any parts are polished say where and whether the backing is of coarse Keene's or Portland.

The salient angles of internal plastering should be finished with either Keene's or Portland cement. Say whether rounded or slightly chamfered, and if horizontal as well as vertical angles are thus treated say so, thus :—

"Finish all the salient angles of internal plastering, both horizontal and vertical, with slightly chamfered angle (or rounded angle, 2 in. girth) and two 2 in. returns."

Archways and Recesses.—State where, and describe the mouldings or chamfers.

"Finish all the soffits and jambs of recesses not exceeding 9 in. depth, plain face in Keene's cement; where over that depth finish the salient angles as described for the salient angles generally."

"Finish the jambs and soffits of all archways on the first floor and west of swing door on the ground floor with Keene's cement plain face, the salient angles chamfered 3 in. wide with splayed stops."

"Treat the archways on the ground floor east of the swing door in a similar manner to last, but moulded 6 in. girth, with moulded stops instead of the chamfers."

Rough Cast.—State its composition, and if on lath, describe the laths, and where it is to be used.

"Lath with double oak laths, render and float with Portland cement and washed sand 1 to 2, and finish with rough cast made of clean, sharp shingle and washed sand in similar proportions, the gables of northern front and the south-western gable."

Incised Plastering.—Sometimes the architect prefers to scratch patterns on the wet panels of Portland cement prepared for his use.

"Render and float the panels below the windows of north front

at such times as the architect shall direct, and afford facilities for him to scratch devices thereon."

Or,

"Render and float the panels below the windows of the northern front and incise ornamental patterns thereon to details to be supplied."

Wall Tiling.—State the size, colour, and quality of the tiles, how fixed, and the name and address of the manufacturer, thus:

"Line the walls of larder for a height of 2 ft. above the lower shelf with Minton's best 6 in. white-glazed tiles, set and pointed with Parian cement. Finish the salient angles with angle tiles to match."

"Similarly line the walls above the butler's pantry sink and draining boards, both back and ends, for a height of 18 in. with similar tiles. Finish the top and ends of the tiling with a moulded flush capping 2 in. high to match. Finish the sills and jambs of the window in a similar manner up to the same level, with angle tiles to match, to the salient angles."

Ornamental tiles may be described at a price each or a price per yard.

Floor Tiling.—Floor tiling and tiling for hearths is best described by a price per yard at manufactory, stating the name and address of the maker, and where it is to be laid. Particular kinds of tiling may be distinguished by a tint on the plans, and so referred to:—

"Lay those parts of the ground floor tinted red on the drawings with Maw & Co.'s (Benthall Works, Jackfield, Shropshire) floor tiling, P. C. 10*s.* per yard at the manufactory, bedded and jointed with cement."

"Lay the hearths of drawing-room and dining-room fireplaces with Minton's ornamental tiling, P. C. 20*s.* per yard at manufactory, and bed and joint in cement."

Or,

"It may be described thus: Lay the floor of urinal with paving of tiles $2\frac{1}{8}$ in. by $2\frac{1}{8}$ in. by $\frac{1}{2}$ in., similar to Pattern 5557, Sheet 51 (Craven, Dunnill & Co., Jackfield Works, Jackfield, Shropshire), set in cement to falls."

Asphalte Paving.—State thickness, the kind, and where laid.

"Pave the whole of basement with the Seyssell Asphalte Co.'s (38, Poultry, E.C.) seyssell asphalte, 1 in. thick laid in two thicknesses, with angle fillets."

Asphalte Skirting.—"Put all around the walls where this paving is used $\frac{3}{4}$ in. skirting, 9 in. high, let into wall 1 in., and pointed with cement."

Asphalte Work to be done by company's own men.—"The whole of this asphalte to be done by the company's own men, and in the best manner."

PLUMBER.

External and Internal Plumbing should be separate Sections.—The external and internal plumbing for a building are best kept separate. For a large building this is specially necessary.

Plumbing as a Provision.—Sometimes the whole of the plumber's work is a provision, in which case a separate contract would be made with a selected firm of plumbers, to whom a specification should be supplied as recommended for other separate contracts. If the specification is supplied by the tradesman, the architect should see that it correctly expresses his intention. An alternative is to send a specification to several firms of plumbers, thus making the tender competitive. The general specification would then contain a clause:—

"The whole of the plumber's work will be done by Messrs. Dent & Hellyer, Newcastle Street, Strand. The general contractor shall supply all scaffolding and ladders, and cut away and make good."

Materials.—Describe the lead, and such minor things as may be necessary to complete the work.

Flashings.—State the weight of the lead, the width of the flashing, the width of the laps, and describe generally where the flashings are to be used, thus:—

"When the lead turns up against vertical faces put cover flashings 6 in. wide of 5 lbs. lead, with 4 in. laps."

Aprons.—Describe weight of lead, their width, their laps, and generally where they are to be used, thus:—

"To all chimneys and other vertical faces where the slopes of roofs run up to them, put aprons of 5 lbs. lead 12 in. wide, with 4 in. laps.

Stepped Flashings.—Describe weight of lead, their width, their lap, and generally where they are to be used, thus:—

"Up rakes of roof, where they adjoin vertical faces, put stepped flashings, 12 in. wide of 5 lbs. lead, with 3 in. laps."

It is not expedient to use a stepped flashing dressed on the roof surface, except for ordinary thin slating; the lead will not dress over thicker slates or tiles in a satisfactory way. For ton slating, stone slating or tiles, either soakers or a secret gutter should be used. Either of them makes neater looking work than the ordinary stepped flashing.

Secret Gutters.—Secret gutters are so likely to be choked by dirt that they are now seldom used. Describe them thus:—

"Up rakes of roof, where they adjoin vertical faces, put a secret gutter of 6 lbs. lead, 3 in. wide, one edge, dressed over a tilting fillet, the other turned up 6 in. against the brickwork or other similar vertical face, and cover with a stepped flashing 7 in. wide of 5 lbs. lead, with 3 in. laps."

Soakers.—State their size and the weight of lead. These, whether for tiles or slates, should be 8 in. wide (in the direction of the length of the roof), *i.e.*, 4 in. on roof plane and 4 in. turning up against the vertical face, and the length equal to a gauge *plus* a lap of the roof covering. By this rule tiles to a $3\frac{1}{2}$ in. gauge should have soakers 8 in. by 7 in. Countess slating to a $2\frac{1}{2}$ in. lap should have soakers 8 in. by $11\frac{1}{4}$ in. They would be specified 8 in. by 12 in. Specify thus:—

"Put to each course of slates where the rake of roof adjoins a vertical face a soaker of 5 lbs. (often 4 lbs.) lead, 8 in. by 12 in., to run up 4 in. against the wall. Cover with stepped flashing 7 in. wide, with 3 in. laps."

When stone slates or ton slates are used the gauge will diminish from eaves to ridge, and the soakers may be thus specified:—

"Put to each course of slates, when the rake of roof adjoins a vertical face, a soaker of 5 lbs. lead, 8 in. wide, by a length equal to a gauge and a lap added together. Cover with stepped flashing 7 in. wide, with 3 in. laps."

"Where the ridges run into slopes of roofs, and where tile ridges intersect, put soakers 18 in. by 18 in., of 5 lbs. lead."

Ridges.—State the width of the lead, or how much it lies on the slating, the weight per foot, and the laps, thus:—

"Cover the hips and ridges with 6 lbs. lead, to lie 7 in. on the slating on each side of the rolls, the laps to be 4 in."

When a close cut and mitred hip is used soakers will be

required. They may lie 6 in. on each plane, and will consequently be 12 in. wide, the length as before, equal to the total of a gauge and a lap.

Describe thus:—

"To the hips which are cut and mitred put to each course of slates a soaker of 5 lbs. lead, 12 in. by 12 in. For stone slating adopt the rule before mentioned."

Valleys.—State the width of the lead, the weight per foot, and the laps. Describe thus:—

"To all valleys put 6 lbs. lead 20 in. wide, with 6 in. laps."

Gutters.—State the weight of lead (the width of the sole of gutter and fall would be described in "Carpenter"), the distance of turn up, both against the wall and under the slating. Describe thus:—

"Lay the gutters with 7 lbs. lead to turn up 6 in. against all vertical faces, and 12 in. up the slope of the roof, measured from the sole of the gutter."

Cesspools.—Describe the lining, the weight of the lead, and the pipe to convey the water from it into the rain-water head or rain-water pipe. The sizes of the cesspools should be described in the Carpenter. Specify as follows:—

"Line the cesspools with 7 lbs. lead, carefully dressed and soldered. Convey the water thence into the rain-water pipes by lengths of drawn lead pipe, weight 6½ lbs. per foot run, carefully tafted and soldered to the cesspool, and bent as required."

If the cesspool discharges with a shoot over a rain-water head omit the description of the pipe, and say:—

"The outer side of the lead of the cesspool to be dressed through the parapet to stand out 3 in. from the external face of the wall, the lead shoot to be as deep as the cesspool, and flashed as described for the general flashings."

Tacks.—Describe their width and weight of lead.

"Secure the flashings, hips and ridges, with tacks of the same weight of lead as that they secure, to be 2 in. wide and about 3 ft. 6 in. apart."

Covers to Outlets.—State the kind as galvanized iron wire, copper wire, domical lead, &c., and make clear whether they are intended to cover the whole cesspool or the outlet only.

"Supply to each outlet of eaves gutter or cesspool a domical cover out of 7 lbs. lead, and pierced as directed."

Or,

"Supply for each outlet of eaves gutters and cesspools a strong copper wire rose."

Or,

"Supply for each cesspool a strong copper wire grating of diamond-tied lattice, $\frac{3}{4}$ in. mesh, and No. 10 B. W. G., the whole size of cesspool."

"Supply for each rain-water head, the whole size of the head, a galvanized iron wire cover of No. 8 B. W. G., $\frac{1}{2}$ in. mesh, with No. 8 B. W. G. frame, and No. 10 B. W. G. ribs."

Ornamental Lead Work.—Describe the position of the work as corrugating or escalloping edges. Clearly describe the parts of woodwork intended to be covered with lead. Sometimes there are doubts whether mouldings are entirely covered, or only the weatherings.

Lead Wedging.—Flashings or aprons should be secured by oak or lead wedges. Describe thus:—

"All flashings and step flashings and aprons to be wedged with lead wedges."

Covering of Finials.—State the weight of lead, and refer to a detail. Describe thus:—

"Cover the finial and its base to roof over bedroom 14 with 8 lbs. lead, bossed out of the solid without soldering, the lower edges of the lead to be cut to an ornamental pattern to design." (See Detail No. 40.)

Dormers and Lanterns.—It is best to specify the lead to such things as these all together, thus:—

"The dormer of bedroom 20 to have cheeks of 6 lbs. lead, apron of 5 lbs. lead 15 in. wide, flashing of 5 lbs. lead 12 in. wide up slopes of roof at their junction with cheeks, soaker 18 in. by 18 in. of 5 lbs. lead where ridge runs into roof slope, &c."

Flats.—Describe the weight of lead and the treatment of under and over cloak:—

"Cover the flat with 7 lbs. lead carefully dressed and bossed over the wooden rolls, the undercloak to cover at least two-thirds of the exposed part of the roll, the overcloak to completely cover the roll, and to lie $1\frac{1}{2}$ in. on the flat beyond. The rolls to be not more than 2 ft. 6 in. apart."

Lead Rain-water Pipes.—State bore, whether round or square, the weight per foot superficial of the lead used, or if drawn the weight per foot run, the kind of tacks and nails, the distance apart of tacks.

"The rain-water pipes to be 3½ in. drawn lead, weight 66 lbs. per 10 ft. length, with ornamental tacks to design out of 7 lbs. lead, each pair to weigh 7 lbs. per foot, the tacks to be about 3 ft. 4 in. from centre to centre, and fixed with four 4 in. gun-metal nails with rose heads to teak plugs in the brickwork."

"Supply all necessary bends, plinth bends, swan necks, &c."

Cast-lead tacks may be obtained in great variety. A number are illustrated in Bolding's list. Describe thus:—

"The rain-water pipes to be 4 in. by 3 in. soldered pipe, out of 8 lbs. lead, with pairs of Bolding's (Davies Street, London) No. 997 cast-lead tacks soldered on about 5 ft. apart, and fixed with stout rose-headed wrought-iron nails to plugs in the brickwork. Supply all bends, swan necks, plinth bends, &c., necessary to complete."

"Each stack to have a shoe to deliver over a gulley. (See Drains.)"

Lead Rain-water Pipe Heads.—Cast-lead rain-water pipe heads are obtainable of stock patterns. If they are made to design they are much more expensive. A sum may be provided, or they may be described by a number from a trade catalogue. They may be described thus:—

"Provide for three rain-water heads and fixing, £21."

Or,

"Supply three rain-water heads, P. C. £4 each at manufactory, and fix them where directed."

Covering to Brick Strings.—State the weight of lead, describe the dressing and the laps. Describe thus:—

"Cover the brick string courses with 5 lbs. lead turned 1 in. into the brickwork at back, and wedged as described for flashings, turned down 1 in. over the front edge, neatly bossed at the angles, and the joints lapped and welted."

Internal Plumbing.

It is advisable before specifying the internal plumbing to obtain the regulations of the local water company.

Water Company.—"The whole of the plumbing to be done to the satisfaction of the local water company and local surveyor, as well as of the architect."

Terms Middling and Strong—Weight of Pipes.—Although the terms middling and strong have only a general meaning, it is convenient for the specification items to define and use them in conjunction with a table thus:—

"The lead pipes are to weigh the following weights per yard in lbs."—

	½ in.	¾ in.	1 in.	1¼ in.	1½ in.	2 in.
Middling	3	5	7	10½	12	14
Strong	6	9	12	16	21	28

"All supplies to be strong, all wastes middling. All pipes above 1¼ in. diameter to have tacks. All joints to be wiped."

In making such a table as the foregoing, which is purely arbitrary, take care that the pipes are as heavy as those prescribed by the regulations of the local water company.

Some architects specify their pipes thus:—

"All lead surface or supply pipes normally kept full of water to be of the following weights"—

½ in.	pipes,	2 lbs.	per foot	lineal.
¾ in.	,,	3 lbs.	,,	,,
1 in.	,,	4 lbs.	,,	,,

"For waste, warning or other pipes, kept normally empty, the weights to be not less than"—

¾ in.	pipes,	2 lbs.	per foot	lineal.
1 in.	,,	3 lbs.	,,	,,
1¼ in.	,,	5 lbs.	,,	,,
1½ in.	,,	6 lbs.	,,	,,

Bends.—It is essential to preserve the full bore of the pipe in all bends.

Protection of Underground Pipes.—"All lead water pipes in the ground shall be laid in 1 in. deal wrought troughs, 3 in. by 3 in. in clear, the trough and cover to be twice tarred inside and out, and the whole trough filled with fine sand."

Some architects specifiy that the box be filled with pitch, but the pipe is then difficult to inspect.

Protection of Pipes Above Ground.—They may be protected by boiler felt bound on, Croggon's matted felt, or slag wool packed into the chase behind the pipe casing. Specify thus:—

"All water pipes above ground shall be coated with glycerine, and well wrapped all round with approved stout canvas-backed woven hair felt, well lapped and bound with strong copper wire."

Or,

"All pipes normally charged with water and exposed to frost shall be covered with a thickness of 2 in. of boiler felt, cut in strips, wound spirally around the pipes and tied with string."

Or,

"Pack all chases containing pipes usually full of water with slag wool, surrounding the pipe and filling the chase."

Slag wool on a canvas backing is also used for this purpose.

Bib Taps.—If a particular maker is required specify it, or a patent like Lord Kelvin's. State whether brass or gun-metal, whether screw-down, loose valve, fullway, strong water works pattern, or London School Board pattern, whether engraved (hot or cold), whether with screw bosses, or a particular patent as Lord Kelvin's.

Loose keys are desirable for some, especially in schools and other public institutions.

Stop-cocks.—State whether brass or gun-metal, whether screw-down, whether with unions at one or both ends, whether engraved.

It is advisable to have a stop-cock in every down service, and near the cistern; one in rising main just where it enters the building. Sometimes it is convenient to put it in a stop-cock box outside the building. It is also convenient to have a stop-cock to such branch services as to ranges of lavatories, to baths, to waste-preventing cisterns, and generally in such branch supplies as it may possibly be necessary to shut off for convenience of repair of apparatus. This ideal of arrangement, if completed, is expensive. They may be described thus generally, and their position should be mentioned:—

"All stop and draw-off cocks shall be the best quality brass high-pressure screw-down cocks, with solid brass spindles, fixed jumpers, loose keys, screw ferrules, and loose unions for lead or iron."

Table of Stop-cocks.—In a large system of water supply a list should be made of all the stop-cocks. Their position and uses are generally written in a tabulated list, framed and glazed, and hung up in one of the domestic offices of the building.

Generally.—"All the lead pipes, stop-cocks, valves, &c., are to be tested by the contractor on completion, and left in perfect working order."

"All brass work to receive soldered joints is to be carefully turned."

Apparatus Generally.—When specifying apparatus or cisterns describe all the plumber's work with it, except the supply; this it is better to include in the section supplies.

Cisterns.—Specify position, if galvanized, size each way, or capacity in gallons, thickness of iron, number of cross-stays, size of overflow pipe, and how connected and where carried to; size of underwaste, how connected and where carried to.

When there are several cisterns, let them follow, and describe them in the same way. If each cistern is designated by a letter, A, B, C, &c., the description of the supplies from each will be much easier.

Iron cisterns have almost entirely superseded those of lead or slate, but they are still used occasionally. Cisterns are often placed where a precise size is indispensable. If the capacity is the only essential the size may be stated with an alternative, "or to hold   gallons."

Wooden Cisterns in "Joiner."—Supply in roof over bedroom 5 a deal cistern 5 ft. by 4 ft. and 3 ft. 6 in. deep, all in clear of $1\frac{1}{2}$ in. sides, cross-tongued and dovetailed at angles, and 2 in. cross-tongued bottom screwed on, all prepared for lining with lead.

In "Plumber."—Line the wooden cistern with 7 lbs. lead, soldered at angles, turned over the upper edges of the sides, and copper nailed. Fix two $\frac{1}{2}$ in. diameter galvanized iron rods across cistern and through the sides, with large head, nut, and washer, and 4 in. by 4 in. by $\frac{3}{8}$ in. washer at each end."

"Encase the rods with $\frac{3}{4}$ in. middling lead pipe, and solder the ends to the cistern lining. Fix 3 in. below the top of cistern $1\frac{1}{2}$ in. middling lead pipe, to discharge over the nearest eaves gutter, and the end bent to deliver the water in the direction of the fall of the gutter. Fit the end of pipe with a hinged copper flap and frame."

"Solder into the bottom of the cistern a 2 in. brass washer and

plug, with fly nut and union, and length of strong brass chain and staple; carry from thence to deliver over channel at ground level on western side of building 2 in. middling lead pipe as waste."

Slate Cisterns.—These are made of various qualities of slate, self-faced, sawn or rubbed. Sawn slate cisterns are kept in stock by the slate merchants, of various capacity from 50 to 500 gallons, and if the shape is not important, it is best and cheapest to describe them by their capacity. If a special size is required the price is higher. The stock sizes include the requisite bolts. They are of the following thicknesses:—

50 and not exceeding 100 gallons -	1 in. thick.
100 to 350 gallons - - - -	$1\frac{1}{2}$,,
400 ,, - - - -	$1\frac{3}{4}$,,
450 to 500 ,, - - - -	2 ,,

Describe thus—

"Supply $1\frac{1}{2}$ in. sawn slate cistern to hold 350 gallons, grooved together and jointed in red lead cement, secured by four $\frac{1}{2}$ in. galvanized iron bolts with heads, nuts, and washers. Cut holes for supplies, waste, and overflow. Fit with $1\frac{1}{2}$ in. boiler screw, and $1\frac{1}{2}$ in. middling lead pipe as overflow carried through roof, with 5 lbs. lead tile soldered on, and $1\frac{1}{2}$ in. copper flap and frame at outlet to deliver into valley over attic corridor; $1\frac{1}{2}$ in. brass washer and waste, with fly nut and union, and 2 in. middling lead pipe carried down to deliver over the nearest gulley in kitchen yard. Fit with plug and strong brass chain and staple for emptying."

Galvanized Wrought-Iron Cisterns.—Galvanized iron cisterns are cheapest if of stock sizes, lists of these sizes are to be found in the lists of the makers of sanitary fittings, as Bolding, Tyler, Farmiloe. They are made of $\frac{3}{16}$ths plate, $\frac{1}{8}$ in. plate, No. 14 gauge. If size and construction is special, state the size each way, thickness of iron, number of cross-stays, size of angle, iron around top and bottom and at angles, size of overflow, how connected, where carried to, size of underwaste, how connected, and where carried to. (See description, p. 117.)

Cast-Iron Tanks.—Very large tanks are often made of cast-iron, bolted together in sections. State size each way in clear, thickness of iron, the number and size of cross-stays, the overflow, the waste, and state where they are carried to. Describe thus—

"Supply in tank room a cast-iron tank 13 ft. 6 in. by 6 ft. 6 in., and 4 ft. deep, all in clear (3 ft. 9 in. of water), built of plates 1 in. thick, with stiffening webs, angles, and six 1 in. stays, &c. All the joints shall be truly planed and caulked with iron cement. Cast on where directed bosses for connection of inlet and outlet pipes, including wash-out and overflow. The overflow to be a 4 in. wrought steel tube, connected to the tank by a flange bedded in red lead and bolted on; this pipe to deliver into the gulley at south-western angle of the coal yard. Connect in a similar manner to the bottom of the tank a similar pipe, but 3 in., and carry into the overflow pipe with a tee piece as junction. Insert in this pipe a strong gun-metal quick turn full-way wheel valve. Insert 3 in. from top Tylor & Son's (Newgate Street) No. $\frac{173}{5}$ 3 in. full-way ball valve, with flanged inlet, copper ball, and wrought-iron rod, and connect to the supply."

The inlet valve in this case is so much a part of the tank, that it has been described with it; properly it should be described with the supplies.

W.C. Apparatus.—Specify by a number and description from a trade list, describe trap, soil-pipe by its diameter and weight per foot run. Tacks if in any way special, how connected with drain and how finished at top.

The seat and brackets may be described here if a pedestal closet. (Seats, risers, and elbows are best described in "Joiner.")

The trade lists of Dent & Hellyer, Doulton, Bolding, Tylor & Son, Jennings, illustrate a great variety of apparatus.

The two leading types of apparatus are the valve apparatus and the "wash-down."

The wash-down type is the most popular, and is commonly a pedestal used with a flap seat. The prejudice against w.c. seats combined with a seat and riser is well founded; the space thus enclosed is often a receptacle for dirt and rubbish.

For women's w.c.'s the valve closet is preferred by many architects. Some of the valve closets are of admirable workmanship, but the greater simplicity of the wash-down or wash-out is strong ground for its adoption. Many of these combine pan and trap in one piece of earthenware. All the valve closets require a drawn lead trap.

In London care must be taken to conform to the by-laws

made by the London County Council under the Public Health (London) Act, 1891.

Some of the closets which meet the requirements of the London County Council are Bolding's patent "Laydas syphonic action closet," Bolding's "Kenon," "Lete," &c.

Slop Tops to W.C. Apparatus.—When no special slop sink has been provided, one of the w.c.'s should have a slop top. A slop top is also reasonable for an apparatus which is likely to be used as a urinal.

Bidets.—These may be described by a number from a trade list.

Soil Pipes.—Soil pipes made of sheet lead with soldered seams are obsolete. They are now, if of lead, always of drawn lead pipe; $3\frac{1}{2}$ in. diameter is the smallest size allowed by the by-laws before referred to, and this is a very reasonable rule. When the drain receiving it is 4 in. the soil pipe must be 4 in.

The following table of weights of pipes, extracted from the by-laws, is a very reasonable one, and they should not be lighter either in town or country:—

Diameter.	Lead. Weight per 10 ft. length not less than	Iron. Weight per 6 ft. length not less than
$3\frac{1}{2}$ in.	65 lbs.	48 lbs.
4 ,,	74 ,,	54 ,,
5 ,,	92 ,,	69 ,,
6 ,,	110 ,,	84 ,,

Soil pipes should be truly vertical from top to bottom, and should be carried up several feet higher than the top of any adjacent window openings.

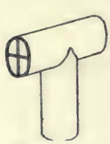


Fig. 119.

Soil pipes are finished at top in various ways, either as item or with a short piece of the soil pipe soldered across the top, as Fig. 119. Describe thus:—

"Solder to the top of soil pipe an 8 in. length of similar soil pipe as cowl, with cross wires soldered into each end, as sketch."

Or,

"Supply to each soil pipe Bolding's No. 1074 simplex ventilating cap."

Or they may finish with a balloon grating of galvanized iron wire or copper wire.

Connections of Lead Pipe with Drain.—Describe thus:—

"Connect each 4 in. lead soil pipe with drain by a 4 in. heavy brass thimble soldered to the pipe and passing through a cast-lead washer ¼ in. thick, and accurately filling the socket of the drain pipe. Seal down with pure cement ½ in. thick, completely covering the top of the drain pipe."

Thimbles may be thus described:—"All brass thimbles are to be heavy cast brass, socketed or flanged, free from all flaws, finished smooth inside and out, and cast large enough to allow the pipe to be passed through without diminishing the bore of the pipe. No thimbles shall be less than 6 in. long, and shall in all cases be long enough to allow the wiped soldered joint to be made clear of the socket of iron pipe. The thimbles shall be turned for soldered joints, and the sockets shall be large enough to allow ½ in. space around for the cement joint."

Connections of Branches into Soil Pipe from Traps of Earthenware W.C.—"Connect the traps of w.c.'s with the soil pipe outside of wall by a length of 3½ in. soil pipe, bent as required, connected to the trap by a 3½ in. brass thimble, soldered to the pipe and jointed in red lead to the trap, and the other end soldered to the vertical pipe."

Testing Soil Pipes.—"Test the soil pipes at completion, plug each soil pipe at bottom, and fill with water to the top, the traps to be temporarily covered with stout lead soldered down and weighted."

Iron Soil and Ventilating Pipes.—These should be heavy, should be galvanized, and the joints should be caulked and run with molten lead. Describe thus:—

"The iron waste soil and ventilating pipes shall weigh not less than the following weights before they are galvanized, and shall measure the clear internal dimension specified. The galvanized work shall be free from flaws, well covered and finished with a smooth surface all over:—"

2 in. pipe,		28 lbs.	per	6 ft.	length and	$\frac{3}{16}$	metal.
3	,,	37	,,	,,	,,	$\frac{3}{16}$	,,
4	,,	48	,,	,,	,,	$\frac{3}{16}$	,,
6	,,	80	,,	,,	,,	$\frac{7}{32}$	,,
3½ in. soil pipe,		48	,,	,,	,,	$\frac{7}{32}$	,,

"All junctions shall be of the same thickness of metal as the pipes and of an approved pattern."

"The whole shall be well galvanized, perfectly smooth inside, free from sand holes, core, spelter, and all other defects."

"Supply all necessary bends, junctions, off-sets, &c."

"The pipes shall have lugs and sockets, the latter formed so that a space of $\frac{1}{4}$ in. is left all around for caulking, and to be fixed sockets upwards with 5 in. galvanized iron nails, driven into teak plugs in the brickwork."

"The joints to ventilating and soil pipes shall be caulked with oakum, run with molten lead, and set up when cold."

"The joints of waste pipes shall be caulked with tow and red lead, except where the joint occurs in the brickwork, when it shall be caulked with oakum, run with blue lead, and set up when cold."

"Fit the ventilating and soil pipes with approved double-capped extract cowls, of plain pattern with spigot ends, to fit inside the socket of the iron pipe with galvanized stout wire guards, of approved shape, fixed over the openings."

"Fit each of the waste pipes with a 6 in. galvanized stout iron wire balloon grating, securely attached with stout copper wire to the pipe."

"Fit all junctions in iron pipes with approved stout brass caps and linings, either at side or back as required, the caps to measure the following sizes inside in the clear, and to be flush inside:—

2 in.	diameter	pipes shall	have	$1\frac{1}{4}$ in.	diameter	cap.
3	,,	,,	,,	$2\frac{1}{4}$	,,	,,
$3\frac{1}{2}$	,,	,,	,,	$2\frac{1}{2}$	,,	,,
4	,,	,,	,,	3	,,	,,

"Where ventilating or waste pipes are carried above eaves gutters, they shall have special long easy off-sets from the wall to clear it if there is not room for the pipe to run up straight behind the gutter and through roof."

"The pipes where they project from the wall shall be without ears, and shall be fixed to the wall with special cast-iron brackets, cut and pinned $4\frac{1}{2}$ in. into the brickwork."

"The pipes above the roof shall be secured by sets of two strong wrought-iron galvanized stays, out of $\frac{3}{4}$ in. diameter wrought-iron rods flattened at ends and screwed to the roof boarding, and bolted at their upper ends with two $\frac{3}{8}$ in. bolts and nuts to double collars out of $1\frac{1}{4}$ in. by $\frac{1}{4}$ in. iron bar."

"The soil pipes shall be coated inside and outside with Dr. Angus Smith's solution, shall be carried up the slopes of the roof and 6 ft. above the ridge."

"Supply and solder to the pipes which pass through the roof 7 lbs. lead slates, 6 in. larger each way than the pipe and dressed down over the slating, with collar 6 in. high soldered to the lead slate."

Testing Iron Soil Pipes.—"Test all the pipes in the presence of the architect or his assistant with an approved smoke machine giving a pressure of 35 lbs. per square inch. The test shall be applied before the cowls are fixed. Any of the pipes or joints which prove defective shall be made good with new, and the test repeated until all is proved to be sound."

Anti-Syphonage Pipes.—These may be of lead or iron. A simple form of anti-syphonage is called a puff pipe, carried from the top of the trap through the wall, and terminating on its external face. They are used for sinks and lavatories, and sometimes for w.c.'s. Describe thus:—

"From the top of trap of sink carry through the external wall $1\frac{1}{2}$ in. middling lead pipe, with $1\frac{1}{2}$ in. cobweb grating soldered in, and flush with wall face."

When several w.c.'s one above another enter the same soil-pipe an anti-syphonage pipe must be taken from the highest point of the arm of the trap of the lowest w.c., and through the wall carried up by the side of the soil-pipe, and connected with it above the arm from the highest w.c. The intermediate w.c.'s connected with it, as Fig. 120. Describe thus:—

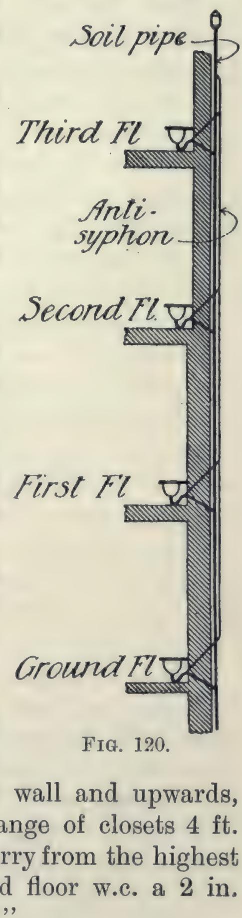


FIG. 120.

"Carry up from the top of the trap of the ground floor w.c. adjoining the western external wall a 2 in. lead pipe through the wall and upwards, and connect it with the soil-pipe of this range of closets 4 ft. above the trap of the w.c. on third floor. Carry from the highest point of the trap of first, second, and third floor w.c. a 2 in. similar pipe into the 2 in. one last described."

Traps.—Lead D-traps and containers for w.c.'s have been entirely superseded by drawn lead traps or by a trap forming part of the earthenware pan. In the latter case they require no other, but valve closets are best connected with anti-D-traps. It is not the practice to fit these traps with caps and screws. Sinks, baths, and lavatories should have drawn lead traps of the full bore of their waste pipes. Each trap should have a brass cap and screw of the same internal diameter as the bore of the pipe. As traps are made in various weights of lead, the smaller ones 4½ lbs., 6 lbs., and 8 lbs., the specification should state which is required.

Waste Preventing Cisterns.—The variety of waste-preventing cisterns is very great. Some local boards and municipalities prescribe a particular pattern. Some of them are very noisy, and for that reason should be rejected. The water companies restrict the flush to 2 gal. This is too little, and in the country it is better to arrange for 3 gal. They are most conveniently supported by iron brackets, and a board at the back of the cistern to which the brackets are attached is usually provided. The flushing-pipe prescribed by the L.C.C. by-laws is 1¼ in. Nothing smaller should be used, and when it is unusually short 1½ in. is necessary. Describe as follows:—

"Supply for each w.c. apparatus Jenning's 3 gal. syphon cast-iron galvanized waste-preventing cistern, with cover, strong brass chain, and wooden pull, fixed on two galvanized cast-iron brackets, screwed to a 1½ in. deal pad, chamfered all round, and nailed to plugs in the brickwork, 2 ft. by 1 ft. 1 in. Connect with the pan by 1¼ in. strong lead flushing pipe. Fit the cistern with ¾ in. middling lead pipe as overflow, carried through wall, and with copper flap and frame soldered in."

When a *general* description is desired something like the following may be adopted:—

"The waste-preventing cisterns shall be 3 gal. galvanized wrought-iron, approved with cover, syphonic, noiseless, with brass tube, copper float, copper syphon, 1½ in. union for 1¼ in. tail piece, with fly nut and washer, and ½ in. high-pressure full-way ball-cock."

Urinals.—Urinals are rarely used in private houses except in the retiring rooms attached to billiard-rooms. A lipped cradle urinal is usually all that is required. This may be fixed either to a slate tablet or to plugs in the wall. They are best described

by number from a trade list. The list description should be adopted, and the waste and other adjuncts described with it.

"Supply in lavatory next to billiard-room Bolding's No. 268 white cradle urinal with shell supply, and fix with screws to plugs in the brickwork. Fit with Doulton's 2 in. straight enamelled tube as waste, and connect with drain. (The water usually laid on with a stop cock or a urinal valve.)"

In the section supplies:—

"Lay on the water to urinal from the nearest supply with $\frac{3}{4}$ in. pipe and Tylor's Fig. $\frac{79}{37}$ non-concussive self-closing stop cock with brass cap and inlet union, New River Company's pattern stamped."

A slop top to the w.c. pan and a hinged flap will serve every purpose of a urinal and will avoid one source of unpleasant smell.

Urinal Ranges.—These may be arranged in various ways. Slate backs and divisions with a sparge pipe and channel, the same with stoneware cradle urinals let into the slate backs. Ranges of urinals in fireclay for the whole necessary height, &c. The slate may be enamelled or the divisions may be of marble. Ranges of iron urinals such as Macfarlane's or Stevens Bros.' As ranges of urinals are often supplied and fixed complete by the makers of sanitary appliances, they are frequently treated as a provisional sum.

"Provide for a range of Doulton's (Lambeth) No. 196 urinal range for four persons (in a recess of the size to admit it), of plain slate backs 5 ft. by 2 ft., and standards 5 ft. by 1 ft. 6 in. with 6 in. enamelled channel below floor line, with weir so as to hold about 2 ft. in depth of water, plain slate tread, copper sparge pipe, automatic tank, and brackets and fixing, 18*l.* Messrs. Doulton & Co. will fix everything, but the builder shall prepare the work to receive it and do any necessary cutting away and making good."

If a description is preferred to a provision describe thus:—

"Supply a range of urinals in the w.c., building for four persons and 5 ft. high, of sawn, rubbed, and sanded slate slabs with all the exposed edges rounded. The back shall be 1 in. rebated to receive the divisions bedded in cement against the brickwork, and the back of each stall to be fixed with six 4 in. copper screws, the heads countersunk and driven into teak plugs in the brickwork. The ends to be 1 in. each, fixed with six copper screws as before. The divisions shall be $1\frac{1}{4}$ in., 18 in.

wide, let into the paving $1\frac{1}{2}$ in., and each fixed to the back by two pairs of gun-metal cramps, as sketch, 6 in. girth (Fig. 121), of $\frac{1}{2}$ in. metal $1\frac{1}{4}$ in. wide, each set fixed with four $\frac{1}{2}$ in. gun-metal bolts."

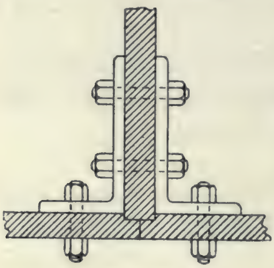


FIG. 121.

"The angles of the ends and divisions shall be quadrant shaped. Lay the whole length of the urinal range, and for a width of 18 in. a paving of best white glazed bricks in cement, falling towards the channel. Lay for the whole length of urinal to fall Winser's best enamelled 6 in. socketed channel to fall, carried through the wall at one end, and to discharge over a gulley. See Drains."

"Fix on the wall at the back of the urinal, on strong cast-iron brackets, a 5 gal. No 16 gauge wrought-iron galvanized automatic syphon flushing tank, reverse action, with outlet from flow-pipe, with $\frac{3}{4}$ in. brass union fly nut and washer, and $\frac{3}{4}$ in. strong lead pipe carried through wall as overflow, with copper flap valve soldered to end."

"Fit the tank with $\frac{1}{2}$ in. brass high pressure ball-cock and pet-cock combined with $\frac{1}{2}$ in. brass union fly nut and washer. Connect the tail piece of the tank with $1\frac{1}{2}$ in. strong lead pipe, carried down to a stout brass tee piece in the middle of the length of the range. Fix to the back of the range for its whole length $\frac{3}{4}$ in. stoutest copper pipe as sparge pipe, with holes about $\frac{3}{8}$ in. apart and $\frac{1}{16}$ in. diameter. Fit the ends of this pipe with stout copper caps screwed on."

Baths.—The trade lists of the sanitary manufacturers illustrate all the known varieties of baths. For a good building copper or porcelain should be used. The latter are very heavy, and care must be taken that they are efficiently supported. Iron, steel, and zinc are also used. Baths may be heated by gas (which is dangerous) or by a "geyser" when no general hot water supply exists. Zinc or copper baths generally require a deal cradle to stiffen them, and an enclosure is necessary to conceal it. They are, however, often used without the cradle, but unless stronger than ordinary they are liable to get out of shape. Iron, steel, or porcelain baths are very frequently used without a riser, with a top only, or a shelf at one end to receive the valves. The enclosure is likely to encourage dust and mice.

Baths are conveniently described by number from a trade list. Specify the length (better than using the words full sized), the valves, the overflow, the waste, and where it goes to, whether the bath is japanned or enamelled, and if this is done inside or outside or both.

Some of the iron baths are combined with the valves and waste.

For description of a porcelain bath, see page 119.

For description of a copper bath, see page 120.

Pantry Sinks.—Sinks for pantries should be of wood, lined with lead or copper.

For lining with lead, see page 119.

For description of a wooden sink, see page 98. If lined with copper describe as follows :—

"Line the two sinks in butler's pantry with tinned copper $3\frac{1}{4}$ lbs. per foot superficial carefully dressed over the top edges and brazed at the joints. Fit each sink with $2\frac{1}{2}$ in. brass pantry washer and plug, and brass No. 10 B. W. gauge chain and chain holder, 3 in. by 2 in. strong anti-D-traps with brass cap and screw, and 2 in. strong lead pipe as waste to deliver over gulley outside of wall."

Scullery or Kitchen Sinks.—Are to be had of various kinds. Glazed stoneware, enamelled fireclay, enamelled iron. State size or a number from a trade list or both. Describe the waste and trap and how fixed. Sometimes these sinks are supported by piers of glazed brick, sometimes by wrought or cast-iron brackets. Reference to the trade lists will show that some are described by outside measure, others by inside measure. Some have overflows or gratings combined with them and some not.

Nursery Sinks.—These are sometimes of fireclay, sometimes of tinned copper, sometimes wood lined with lead. The sanitary trade lists give illustrations of all of them. Nursery sinks may be obtained with all their adjuncts, as draining boards, valves, brackets. If any of these are adopted, describe them by number, adopting the list number and description. It will be necessary to describe the laying on of the water, the trap, the waste, and where it goes.

Draining Boards.—For description of draining board, see page 100.

For description of covering with lead, see page 119.

If the draining board is covered with pewter, describe as follows :—

"Cover the draining boards with bright polished pewter, weighing $3\frac{1}{2}$ lbs. per foot superficial, neatly dressed into the

grooves, turned over the edges, and closely copper nailed at the back."

Lavatories.—These may be lavatory basins fixed in a slate or marble top. The basins may be round or oval. The overflow may be a part of the basin or a separate arm communicating with a pipe. They may be of porcelain or fireclay, and the basin and top combined, or they may be of cast-iron. The basins may be fixed or tip-up.

Some of the manufacturers of sanitary ware supply sets, comprising basin, top, valves, and wooden enclosure.

For lavatories generally, describe top, skirting, basin (internal size), trap, waste, and where it delivers, valves, overflow, top, skirting, and enclosure.

The descriptions are often most convenient by number from a trade list.

Tip-up Lavatory.—"Fit the lavatory with $1\frac{1}{4}$ in. polished Sicilian marble top, fixed on deal bearers plugged to the wall and pinned into the brickwork 2 in. at back and ends. Mould the exposed edge of the slab. Cut hole for basin and round the exposed edge of the hole. Finish around with 9 in. by 1 in. Sicilian marble skirting, fixed with brass screws and cups let in flush and screwed to teak plugs in the wall. Mould the edges, and mould and shape the ends."

"Supply Twyford's (Cliff Vale Potteries, Hanley) No. 498 oval porcelain improved tip-up basin 19 in. by 14 in. with No. 499 oval receiver, fixed to the slab with gun-metal screws in lead plugs, and fitted with their No. 506 fittings, 2 in. Dubois trap out of 8 lbs. lead, with 2 in. brass cap and screw, brass union and fly nut and 2 in. lead waste to discharge into a gulley outside of wall."

"Supply Twyford's 805A plated hot and cold screw down taps with rubber buffers, and connect with supplies."

Safes.—Every cistern (except waste-preventers) w.c., bath, lavatory, and sink on upper floors should have a safe and waste. The lead waste to each should be as large as the supply to the cistern or apparatus.

For preparation for safes, see page 82.

For lead safes and their wastes, see page 117.

Slop Sinks.—These are best described by a number from a trade list. The lists of makers of sanitary apparatus illustrate them. In many cases the slop sink with the whole of the adjuncts is

supplied together, as hopper pan, slate top (back and sides), trap, hot and cold valves and standards. The combinations vary considerably. Describe the soil pipe and where it goes to, and the hot and cold supplies.

The simplest arrangement is an iron or earthenware slop sink with a wooden enclosure, described thus:—

In Plumber.

"Supply in the housemaid's closet Bolding's No. 188 white ariston slop sink, with lead trap and stand. Connect by $3\frac{1}{2}$ in. soil pipe as described with the adjacent vertical soil pipe. Connect the ventilating arm by a 2 in. lead pipe with the adjacent anti-syphonage pipe."

In Joiner.

"Enclose the slop sink in housemaid's closet by $1\frac{1}{4}$ in. square framed enclosure with $1\frac{1}{4}$ in. square framed one panel door hung with $2\frac{1}{2}$ in. iron butts. Fit with strong brass knob turn-buckle. The top shall be $1\frac{1}{4}$ in. mortise and mitre clamped flap and beaded frame, the flap hung with $2\frac{1}{2}$ in. brass butts."

Describe also the laying on of hot and cold water.

If one of the w.c. apparatus is described with a slop top it will serve most of the purposes of a slop sink, but not all.

Automatic Flushing Cistern.—For description, see page 48.

Supplies.—Describe first the main down pipe, the one that goes furthest from the particular cistern, and in all cases begin with the connection, follow with the pipe and conclude with the cock, thus:—

"From cistern A with 1 in. brass cistern connector with fly-nut and union and 1 in. pipe; lay on as far as ceiling of ground floor; thence with $\frac{3}{4}$ in. pipe and $\frac{3}{4}$ in. bib-cock continue to scullery sink."

"From pipe last described, with 1 in. pipe, lay on the water to bath."

Describe the remaining branches in the same manner. If there is another main pipe from the same cistern, follow with this and its branches in a similar way.

Follow with the supplies from cisterns B and C.

"All pipes to be laid with a slight fall towards the main to facilitate emptying."

Tap for Emptying Pipes.—There should be at the lowest level of the supply pipe a tap for emptying the pipes, and in a large scheme several.

Special supply of Drinking Water.—Sometimes a special supply pipe for drinking water is laid direct from the main (instead of from the cistern) to various parts of the house.

Hose for Washing Floors, &c.—"Fix in stable yard 2 ft. north of stable door a $\frac{3}{4}$ in. gun-metal bib tap, with screw nozzle for hose, and supply 60 ft. of $\frac{3}{4}$ in. three-ply best quality approved rubber hose pipe in two lengths, with gun-metal cock, jet, spreading nozzle, connectors and couplings. The hose connectors and couplings to be the Metropolitan Fire Brigade new regulation pattern, in gun-metal, with round topped threads."

Drinking Fountains.—These should be described by a number in a trade list. They are made in plain and decorated porcelain, faïence and majolica. Twyford, Doulton, and Burmantofts, among others, supply them. As there is possible splashing, they should be fixed in a slate slab, glazed brickwork, or salt glazed brickwork. Describe the supply and waste. Describe thus:—

"Supply Doulton's (Fig. 39) white drinking fountain, with tap and waste holes let into the brickwork and bedded in cement. Fit with $1\frac{1}{4}$ strong lead pipe as waste to deliver over gulley."

"Lay on the water from the nearest supply with $\frac{3}{4}$ in. strong lead pipe, and $\frac{3}{4}$ in. gun-metal cam action valve with screw boss."

"Supply strong galvanized iron chain and staple, and two No. 12 W. G. zinc spun drinking cups with $\frac{1}{4}$ in. bead on edge."

Pumps.—Pumps are used when the source of supply is a well or a rain-water tank. The simplest form is a lift pump. The limit of distance from the surface of the ground to the water in which a lift pump will work is not more than 28 ft., in practice 25 ft. is a more reasonable rule. They would deliver their water over a sink or a gulley at the pump level. They vary very much in their quality and finish. A pump for rain-water would be thus described:—

Rain-Water Pumps.—"Fix adjoining the sink in scullery Tylor & Son's Fig. 232 $2\frac{1}{2}$ in. improved jack pump with brass barrel, screwed to a 9 in. by $1\frac{1}{2}$ in. oak plank, wrought and chamfered, fixed with screws to teak plugs in the wall. Connect with the rain-water tank in the garden by 2 in. lead pipes, weight 28 lbs. per yard. Solder to the lower end of the suction pipe Tylor & Son's Fig. $\frac{256}{3}$ gun-metal foot valve and strainer."

When the depth exceeds 25 ft. a deep well pump will be necessary.

Lift and Force Pump.—If the source of supply is a well, and it is required to force the water to a cistern at a high level from which it will circulate by gravitation in the ordinary way, a lift and force pump will be used. Describe thus:—

"Supply in scullery Tylor & Son's Fig. 229 $2\frac{1}{2}$ in. best strong gun-metal pump on plank, screwed to teak plugs in the wall. Connect with the well by 2 in. lead pipe, weight 28 lbs. per yard. Solder to the lower end of the suction pipe Tylor & Son's Fig. $\frac{256}{3}$ gun-metal foot valve and strainer, the rising main from pump to cistern to be $1\frac{1}{4}$ in. lead pipe, weight 16 lbs. per yard. With $\frac{1}{2}$ in. double-nutted boiler screw, bring from cistern $\frac{1}{2}$ in. middling lead pipe to deliver over scullery sink as warning pipe."

Deep Well Pump.—When the well is deeper than 25 ft. a deep well pump must be used for a similar purpose, described thus:—

"Supply and fix in well Tylor & Son's pumping apparatus, Fig. 201, including frame, well rods, roller guides for wooden stages, cast-iron flanged pipes, air vessel, 3 in. pump strainer, and cast-iron pump-bearer. Connect with the iron pipe about ground level $1\frac{1}{2}$ in. lead pipe, weight 21 lbs. per yard, and carry it up to deliver into cistern C. Supply in well 9 in. by 3 in. sawn oak bearers as pump stage and guides."

"Cover the well with 3 in. by 9 in. oak sawn planks, to rest 6 in. at each end on the brickwork."

"Connect with cistern by $\frac{1}{2}$ in. double-nutted boiler screw, and bring down from thence and through external wall within sight from the pumping gear, $\frac{1}{2}$ in. middling lead pipe as warning pipe."

Deep well pumps may be worked by manual power, horse power, a steam, gas, or hot air engine, or by an electric motor.

A hydraulic ram, a turbine, or a pulsometer may also be used as a means of raising water.

Water Softening Apparatus.—The process generally used for very large establishments is Dr. Clark's. It may be seen in operation at the Herbert Military Hospital, Shooter's Hill, Woolwich, and is described and illustrated in a parliamentary report on that hospital, 1865.

A more convenient arrangement for ordinary purposes is Maignen's (255, Regent Street, London) patent process for softening hard water. This is illustrated in their published list. The apparatus is an adjunct to the ordinary house cistern. The

general supply is laid on to the apparatus, and is thence brought to the house cistern, and is supplied to the various parts of the house in the ordinary way. Describe thus :—

"Supply Maignen's apparatus for softening water, Plant No. 2, and connect with the rising main. Connect the softening cistern with the general house cistern by 1 in. strong lead pipe and two double-nutted boiler screws. Connect the general house cistern with the filtering cistern by ¾ in. strong lead pipe and two double-nutted boiler screws."

In the Carpenter.

"Supply for support of softening cistern and general house cistern 4 in. by 3 in. wrought and framed stands of legs and bearers."

Constant Supply.—In London and some of the larger towns there is a constant supply of water, and in some storage cisterns are forbidden. This is, however, not a London restriction. Some architects under these circumstances dispense with a storage cistern, but the policy is questionable. It is always an advantage to have such a cistern, but water may be laid on to a convenient point direct from the rising main. Describe thus :—

"With ¾ in. lead pipe and ¾ in. bib-cock lay on the water from the rising main close to its entry from the street to the scullery sink."

Water Meters.—The supply of water by meter involves an obligation to use or pay for a minimum quantity.

The meter is supplied by the water company at a rental, and the consumer pays for fixing. Describe thus :—

"Pay the water company's charge for fixing and connecting meter. Build a chamber for the meter of 1 brick sides and brick flat bottom all in cement on cement concrete 9 in. thick, 2 ft. 6 in. by 2 ft., and of the depth required. Fix the cover supplied by the company."

Hot-water Supply.—Describe the pipes, and whether galvanized. They should be called "steam tubing."

Describe hot-water cistern or cylinder, its position, quality, and capacity, expansion pipe, size of flow and return pipe.

Describe safety-valve and where fixed.

The pipes for supply will be connected with the flow or return ; describe their size and the valves.

The cold-water supply would be described with the cold-water supplies.

Back Boiler.—The ordinary source of a domestic supply of hot water is the boiler at the back of the kitchen range. The back boiler is always supplied of sufficient size for ordinary purposes, indeed, it is quite possible to have it too large for ready efficiency.

Cylinder.—The cylinder is most useful if placed near the range. It is, however, sometimes placed in a linen closet for the sake of the heat derivable from it.

Draw Offs should be taken off Flow.—The draw offs should be taken from the flowpipe, although sometimes they are taken from the return.

Expansion Pipe.—An expansion pipe should be taken from the highest point of the flow pipe, and it is usually carried up through the roof.

A long branch pipe connected with a distant draw off tap, as it will have no circulation, should be avoided; it should be a double line of pipe as a subordinate flow and return, *i.e.*, starting from the main flow and returning into the main return.

Lagging Cylinder.—To avoid loss of heat the cylinder and parts of the flow and return are sometimes covered with boiler felt or matted felt, and the cylinder is sometimes in addition cased with wood.

Flow and Return in Duplicate.—If there is more than one range with a boiler they may each be the source of a flow and return, and with a cylinder to each it will be convenient to be able to shut off one from the other by a stop cock, so as to use one or both at will.

Special Boiler for Hot Water Supply.—In a very large establishment there must be a special boiler for the hot water supply independent of the ranges. The principle adopted will, however, be the same.

Cold Water Service for a very large Building.—In such a case the supplies from the subordinate cisterns would be described in the ordinary way. The main would be brought from a company's main from a reservoir or a tank on a water tower.

The pipes would be large and subject to exceptional pressure, and consequently of iron. They should be clearly shown on a block plan.

For description of pipes see "Fire Mains." Describe further as follows:—

Mains.—"Lay along the outside of the building, as shown by red lines on the plan of the water service, two 4 in. strong cast-iron pipes, with ends fitted with 4 in. valves, prepared for attaching

to large main from reservoir. These mains shall be provided with 2 in. outlet pieces for vertical mains as follows:—"

"Two for front buildings, eleven for w.c.'s at ends of wards. Carry up from thence vertical mains in 2 in. iron pipe up to the lavatories and water closets on the first and second floors with 2 in. outlet pieces for the ground floor service. Fit each vertical main with a 2 in. stop valve."

"Lay through the centre of the building, as shown by a red line on the plan of the water service, a 4 in. main fitted with a 4 in. stop valve, and prepared for attachment to large main as before. Fit this main with seventeen 2 in. outlets as follows:—One for lavatory and w.c. in lunatic wards, ground floor, eleven for ward sculleries, one for dispensary, one for operating ward, two for bath-rooms, and one for kitchen."

FIRE MAINS.

Source of Supply for Fire Mains.—A system of fire mains is only used for a large building. In a town the water is laid on from the water company's main, and in such case the pressure is fairly high; for a country mansion the pressure must be derived from a source at a level considerably higher than the house if hydrants are to be used. This may be a reservoir on higher ground or a tank in a water tower. When pressure is not attainable in either of these ways a fire engine must be used, and some country houses and institutions in the country have them.

Hydrants.—Hydrants may be placed either in various places inside the building or they may be placed at intervals on a water main running all around the building outside.

Hose and Apparatus.—Near each hydrant should be placed the hose with branch pipe, wrenches, and axe ready for immediate use, sometimes placed in cupboards.

The various applications of mains, hydrants, and cisterns are illustrated in the trade lists of Merryweather & Sons, Shand, Mason & Co., and others.

ZINC WORKER.

The trade lists of the zinc workers will afford the necessary information.

GLAZIER.

Quality—Samples.—There are so many different kinds and qualities of glass now made, and so much inferior glass is now

put on the market, that it is especially necessary to be precise in specifying the glass required. The only way to be certain of getting what is specified is to see the contractor's invoices and receipts, but this is vexatious and causes friction. The alternative is to stipulate that samples of the glass to be used shall be deposited with the architect before signing the contract. Supervision of quality is best maintained by a stipulation that the glazing shall be done on the premises; the glass may then be inspected before glazing.

It is not advisable to encumber a specification with references to those ordinary precautions which devolve upon the builder as a matter of course; such as glazing the vertical sashes perfectly upright, making templets for curved glass, or sizing all ground-glass to avoid soiling by putty, &c., as these are all implied in his general obligation to carry out the work in a sound and workmanlike manner.

Positions.—Careful judgment is required in deciding in what positions to use the various descriptions of glass, and every architect must judge for himself as to this. Generally speaking, the better kinds of glass should be used wherever there is a good outlook, and in the best apartments. Internally, for screens, &c., some form of ornamental rolled plate looks best, or better still leaded lights.

Sizes.—The available sizes of glass of all kinds may be found in the current builders' price books. A familiarity with them is necessary, so as to avoid specifying for a particular purpose glass not made of the required size.

Double Glazing.—It is sometimes found necessary to double-glaze the windows facing North and East (Fig. 122), especially in exposed positions, or in such places as hospital wards. It is usual and better to leave a little air space between each sheet.

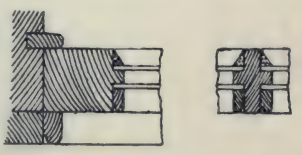


FIG. 122.

Frequently in the case of lead lights double-glazing is resorted to in order to prevent draughts. They are usually glazed inside with sheet glass.

Sheet Glass.—The chief distinction is that between British and Foreign sheet.

British.—There are four qualities in general use:—

Bests and Seconds are excellent, though not without bubbles or scratches.

Thirds is the quality in most general use.

Fourths is the quality used in speculative work.

The weights obtainable in all qualities are—15 oz., 21 oz., 26 oz., 32 oz., 36 oz., 42 oz. per foot superficial.

Twenty-one oz. and 26 oz. are those most commonly used for ordinary work; 15 oz. is rarely used in the better qualities; and the heavy weights are used for panels of doors, or where plate glass would be used except for the expense.

Obscured, fluted, and enamelled glass is supplied of the same weights.

Foreign Sheet.—Foreign sheet is not so white or clear as British, and has more imperfections.

A fifth quality is obtainable in foreign glass, called "coarse," which is sometimes used for greenhouses, forcing frames, &c.

Each quality is obtainable in three grades, viz., ordinary, best, and special.

The weights obtainable in all qualities are—15 oz., 21 oz., 26 oz., 28 oz., 32 oz.

Foreign obscured, fluted, and enamelled glass is obtainable chiefly in 15 oz. or 21 oz.

Glazing.—Glazing to wood sashes externally should always be done in putty, to iron sashes in red lead cement, and internally with beads, either bradded or screwed.

The edges of all glass in doors or sliding panels should be bedded in wash-leather or vulcanized indiarubber.

In the case of long skylights, where the sheets overlap, lead, zinc, or copper clips must be specified, hooked on to the head of the lower sheet, and turned over the lower edge of upper sheet. The length of lap will vary according to the slope. It is a good plan to cut the lower edges of panes segmental or pointed, so as to direct water to centre of pane. For slopes up to 45°, when so cut, specify 1½ in. lap, or 60°, 1 in. lap.

Glass for Horticultural Purposes.—Horticultural glass is sold in stock sizes, ranging from 14 in. by 10 in. to 24 in. by 18 in., and it will be found economical to arrange the glazing bars to suit these sizes, and so avoid further cutting.

Leaded Lights.—Ordinary lead lights vary in price according to the quality of glass used, and the width and thickness of the lead came, and the size of the squares or quarries.

A large variety of cames will be found in Messrs. T. & W. Farmiloes' list, lettered A. to W. They are either round beaded,

flat beaded, or half round. Messrs. Wenham & Waters advertise a special process of theirs by which the bands are closed down to the glass, and the cement is hermetically sealed, and weather-proof, as Fig. 123. The cames are soldered at the junctions with one another.

FIG. 123.

Lead lights can be fixed either with loose beads or by means of copper wire soldered to the borders, and threaded through holes in the sash bars; but a better plan, when fixing to iron, is to secure them with copper ties, and lead rivets.

When a price is obtained for the purpose of inserting in the specification as a provision, the amount may either be so much per foot superficial at works, exclusive of packing, carriage and profit, or the whole sum may be included as a provision.

Patent Systems of Roof Glazing.—For glazing large areas of skylights, especially where they are subjected to much vibrations, as in Factories, Railway Stations, &c., it is advisable to specify some simple system of glazing without putty by means of metal bars, which clip the glass on both sides. The metal should be either zinc, copper or lead, or some alloy which will not require paint. The bars must of course be absolutely water-tight, and must have some provision for carrying off condensation water, so as to prevent it dripping from the bars on to engines, work-tables, &c.

In most cases the patentee sends his own men to fix, and provides the glass. Provision must be made for him to be allowed the use of the builder's scaffold and ladders. In some cases it is necessary to provide a skeleton skylight, to receive the glazing or wood or the iron secondary bars or lead flashings or clips. These requirements must be carefully ascertained and included in the builder's specification, or they will be charged as extras.

The following are among the systems most used now :—

Rendle's Invincible (5, Victoria Street, London, S.W.). Secondary bars (wood or iron) are optional.

Mellowes' Eclipse (28, Victoria Street, S.W.). Flashings required at each purlin. They may be of 4 lbs. lead, and either included in the builders' work or provided by Mellowes at $2\frac{1}{2}d.$ per foot run, P. C. The copper clips are supplied by Mellowes.

Shelley's Unique (Henry Hope, Lionel Street, Birmingham).

Helliwell's Economic (9, Victoria Street, London, S.W.). Three varieties according to distance apart of purlins :—

Ordinary = 6 ft. 6 in.
Medium = 9 ft.
Strong = 12 ft.

The latter can be strengthened to carry 20 ft. without purlin.

Gold Medal Victoria (Sam Deards, Harlow, Essex).

Grover & Co. (Britannia Works, Wharf Road, City Road, London, N.). The bar is sold separately, which is an advantage, as it saves a double profit on the glass. It is made to receive 21 oz. sheet or ¼ in. rough plate. Copper nails for fastening the strips are supplied. Longest lengths obtainable = 17 ft. 6 in. Angles of the strips are to be painted with thick white lead paint before dressing down.

Materials.—Describe quality of glass. State if edges of glass in door panels are to be blacked or bedded in indiarubber or wash-leather. "Supply templates for lead glazing."

Specify the thickness of plate glass as *about* ¼ in. thick, as glass to an exact thickness costs more.

Commence with cheaper kinds as in a bill of quantities, *i.e.*:—

Sheet Glass.—Sheet of each weight per foot super, as 15 oz., 21 oz., &c., clear. Follow with a description of any part obscured.

Rolled Plate.—Follow with rolled plate of the various thicknesses.

Rough Plate.—Specify the thickness of rough plate and its position.

British Polished Plate.—Specify the position of clear glass.

Follow with a description of any parts obscured or embossed.

Brilliant Cutting.—Brilliant cutting is charged with the glass, and it is best described with it. The P. C. per foot superficial of glass, including cutting, should be described.

Lead Lights.—Specify the kind of glass and the number of borders, and their kind and size, and distance apart of saddle bars.

Painted glass is best treated as a provision, including saddle bars.

Iron Casements.—The places where these occur should be marked on the elevations, and the name of the maker should

be given. They are best described by a number and price from a trade list.

Leave Clean.—"Leave all glass clean and perfect at completion of works."

Bevelled Edge.—State width of bevel, and whether bevelled on both sides of the glass.

Pavement Lights.—These are used for lighting basements, and may either be in the pavement of the public way, or in the flooring of the ground floor.

Before using them in a public footway the regulations of the district should be consulted. If their size or kind is doubtful at the time of writing the specification, a sum must be provided for them. If they are specified in detail, adopt the precise description of the trade list, and observe that stock sizes will be much cheaper than special ones. Hayward Bros. & Eckstein, Hyatt, and the St. Pancras Iron Work Company are the principal makers. The pattern and the kind of glazing varies considerably; they may also be made movable, running on wheels or hung as cellar flaps. "Supply to each area of street front Hayward Bros. & Eckstein (Union Street, Borough) 3B Edinburgh pattern semi-prism pavement light 5 ft. $3\frac{3}{4}$ in. by 1 ft. $5\frac{1}{4}$ in. over all, and bed it in cement."

"Each pavement light to have four No. 111 seven-hole ventilating panels."

In Mason.

"Supply for each area of street front 9 in. by 4 in. rubbed York curb, rebated for the frame of the pavement light, set and jointed in cement, the front, and two returns shall each be in one length."

PAINTER.

Materials.—Describe quality.

On Iron.—Specify the number of coats, and whether any of them are to be in special paint, such as Torbay paint.

Painting on Separate Contracts.—In separate contracts for structural iron-work the painting is sometimes done by the contractor for the iron. Sometimes he gives it only one coat (before fixing), and the general contractor does the rest. This latter arrangement is the more convenient, but the specification should clearly express the intention.

If iron straps and bolts are to be oiled, describe thus:—

"All iron straps and bolts shall be dipped while hot in linseed oil."

On Woodwork.—Is best described as "knot, prime, stop, and three oils," or as the case may be. There can then be no doubt about the priming and the legitimacy of calling it a coat.

Sometimes the specification prescribes that the paint shall be of a different tint for each coat. Describe thus:—

Tint of each Coat of Paint to differ from others.—"The whole of the painting shall be of a different tint for each coat, and no coat of paint shall be covered by another until it has been inspected and passed by the architect or clerk of works."

Varnishing.—When much wear is probable painting should be varnished one or two coats. This is sometimes done in domestic offices or in schools. As a compromise the last coat is sometimes mixed with varnish.

Graining, Marbling and Varnishing.—Specify the graining as "grain in addition to the coats before mentioned," and state the kind, and its position, and how many times varnished.

If over-grained or only combed, state it. Graining and marbling varies so much in quality, that reference to a pattern is the best way to ensure good work. Describe thus:—

"The whole of the graining to be grained and over-grained, sized, and twice varnished, in addition to the coats of paint specified, and each particular kind shall be equal to a specimen to be seen at the architect's office."

Marbling.—Marbling may be dealt with in a similar manner.

Enamelling.—Enamelling, if well done, requires more preparatory painting than ordinary. The following should produce good work:—

"Knot, prime, stop and paint, five oils, thoroughly rub down after each coat with felt, and finish with two further coats of Charlton white enamel paint."

Flatting.—Make it clear that the flatting is an extra coat, thus:—

"Knot, prime, stop and paint, four oils, and flat one coat in addition."

Parti-colors. — Describe which parts of the work are in parti-colors.

Picking out of Mouldings.—If any of the mouldings are picked out in a different tint, specify where, thus:—

"All the mouldings of doors, jamb linings, and window backs shall be picked out in a tint to be approved."

"The wooden cornice of library to have two of its members picked out in different tints, making three in all."

French Polishing.—Define the kind as French polish, dull French polish, &c., and where, as if covered with thick brown paper as protection.

Touch-up.—Touch-up at completion, and leave perfect.

Oiling.—If teak or oak work is oiled, specify the number of times.

Distempering.—Distempering is often done by painters. If a tint say so, if an "extra" tint say so. All tints, except the very plainest, are called "extra" tints.

Gilding.—State whether once or twice, the latter called double gilt. Describe thus:—

"Size and double gild with the best English gold leaf, well burnished, the wooden letters on the western front."

"Dutch metal shall not be used."

Writing.—"Paint on doors in Roman shaded letters, 2 in. high, Matron, Superintendent, Porter, Board-Room."

Sometimes:—

"Provide 200 in. of writing in shaded Roman letters in two tints."

Staining and Varnishing.—Staining and varnishing, if the results are to be satisfactory, is always more expensive than painting. The wood should be selected, and costs more to prepare. Moreover, its appearance is nearly always rapidly impaired; and the result of bruises cannot be concealed, whereas in painting, cleaning and a few coats of paint will often make the joinery look as well as it did when new.

Specify the staining, whether oil or water stain, and how many times varnished.

Oil stain is the most durable.

In Joiner.

"The whole of the joinery intended to be stained to be of the best selected deal, finished entirely with the plane without sand paper, and carefully protected until completion."

In Painter.

"The joinery of dining and drawing rooms to be stained with

Swinburne's stain, let down with water, and put on with two brushes, sized and twice varnished with the best copal varnish."

"The inside linings of the windows shall be stained; the outsides of the external doors will be painted."

PAPERHANGER.

Trade Discounts.—As the trade discount on papers varies considerably, and in some cases is only a cash discount, it is best to state the name of the manufacturer who shall supply the papers. They may then be described at a price per piece, list price, or P. C. if the discount is known.

Preparation of Walls.—State how the paper shall be hung, and describe the preparation of the walls.

Delay of Paperhangers' Work.—Paper hung within the contract period is nearly always spoiled and discoloured by the drying of the plastering. The paperhanging is therefore delayed by some until it is thought that it may be hung with safety. If this is intended it should be the subject of a condition something like the following:—

"The architect shall have power to delay any part of the internal painting or papering if he should so desire, and contractor shall do such work at any time within a period of six months from the completion of the remainder of the works as may be directed."

Distempering Walls before Papering.—Sometimes the walls are distempered with the intention of hanging the papers at a future time. The objection to this practice is that the distempering should be washed off before the papers are hung if the papering is to be satisfactory.

Use of Lining Paper.—Another and a better plan is to paper the whole house with tinted lining papers. On these, in the future, the decorative papers may be hung.

Preparation of Walls.—Some preparation of the plastering is always necessary before hanging paper; often it is not done. Describe thus for good work:—

"Thoroughly rub down with glass paper to a perfectly smooth surface, or clearcolle with white lead and size all plastered walls intended to be papered."

Or,

Rub down and size.

Paste.—"The paste shall be made with best sifted flour and alum."

Size.—"The size shall be 'double,' and perfectly fresh."

Papering on Old Walls.—When the paperhanging is on an old wall describe thus:—

"Strip off the paper bare to the plastering and thoroughly wash the wall with warm water and soda. Deepen all cracks, stop with Keene's cement, fill up with clearcolle made of white lead, and size and rub down with sand paper to a thoroughly smooth surface."

Dadoes and Friezes.—In describing walls papered with dado, filling, and frieze, it is reasonable to describe the width of frieze and dado, more especially when the builder is not supplied with quantities.

Papers.—Lining paper varies in weight and quality, but if a particular manufacturer is selected this may be regulated by the price per piece.

Papers may be French, hand-printed, printed in oil colours, flock, &c. State manufacturer and price per yard.

Marble Papers.—These may be lined out in blocks, *i.e.*, hung in lengths in the ordinary way, with a pencil mark for the joint, or hung in blocks, that is, the paper cut into rectangular pieces of about two superficial feet before hanging. Describe thus:—

"Hang the walls of staircase and hall with marble paper, P. C. 3*s*. per piece, lined out with pencil, twice sized and twice varnished with the best extra pale paper varnish."

Or,

"Hang the walls of staircase and hall with marble paper, P. C. 3*s*. per piece, hung in blocks, twice sized and twice varnished with the best extra pale paper varnish."

Old Papers.—Old paper should on no account be papered over.

Sanitary Papers.—Sanitary papers are glazed papers which are said to be washable. They are used for bathrooms and w.c.'s.

Flock Papers.—Flock papers are used both in their natural condition and painted. If painted, they should be finished flat.

Papers with Patterns in Relief.—Lincrusta-Walton, Anaglypta, Tynecastle tapestry, and Japanese leather paper are the principal materials of this class. Friezes, dado rails, and picture rails are supplied by the same manufacturers. They should have brown lining paper hung to receive them, and should be fixed

with glue. They are most definitely specified by the P. C. per superficial yard. Describe thus :—

Lincrusta-Walton.—"Supply dado on principal staircase and hall and in corridor first floor between top of stairs and swing door, 2 ft. 6 in. high, of Lincrusta-Walton, P. C. 4*s*. per square yard, hung on stoutest brown lining paper, and both papers hung with glue. Paint two oils and one coat flat to a selected tint."

VENTILATION.

Necessity for Ventilation.—The accurate fitting of modern joinery makes special inlets for fresh air necessary.

Deep Beads to Sash Frames.—In bedrooms a deep bead to the sash frames is generally sufficient. (See page 80.)

Hygiastic Stoves.—A hygiastic stove is a means of introducing fresh air, cold in the summer and warm in the winter. (See page 414.)

Tobin's Tubes.—Tobin's tubes are good inlets, but hardly suitable for rooms other than class-rooms, school-rooms, or public halls. Describe thus :—

Gratings.—"Supply and fix as inlets to ventilating tubes No. 18, 9 in. by 6 in. cast-iron ornamental gratings, and form and render the openings through walls with cement."

Tobin's Tubes.—"Supply and fix No. 18 Tobin's tubes, to be made of 1 in. deal wrought both sides 9 in. by 6 in. in clear and 6 ft. high, the external angles rebated and staffbeaded."

"Finish at top with 1¼ in. deal mitre-clamped flap, hung with 2 in. brass butts to stile, and the exposed edges rounded."

"Fix in the mouth of each tube a piece of galvanized iron wire netting. The walls will form the backs of the tubes, which are to be accurately scribed and fitted thereto."

"The Tobin tubes are to be in the following rooms, viz. :—Two in board room, six in second-class swimming bath, six in women's swimming bath, four in washhouse."

Boyle's or Sheringham's ventilators are sometimes used as inlets. Describe thus :—

Boyle's Ventilators.—"Fix where directed in boys' dining hall three Boyle's bracket air inlets, with adjusting valve but no air strainer. Form openings through walls rendered in cement, and fix on outer face of wall 9 in. by 6 in. cast-iron ornamental air grating. Put one similar inlet in each of the master's sitting rooms."

Outlet Ventilators.—Outlets may be had in great variety, and some of them may act as inlets or outlets according to circumstances. Describe Cooper's ventilators thus. They may be of any quality of glass in ordinary use for windows.

"Fit one of the topmost panes of glass in bedrooms 2, 6 and 9 with Cooper's ventilators 9 in. diameter in 26 oz. sheet."

Moore's ventilators would fill up the whole pane, and would be described thus :—

"Fit one of the topmost panes of glass in bedrooms 2, 6 and 9 with Moore's patent improved best quality louvre ventilator with brass frame and polished plate glass louvres."

Hayward's mica outlet ventilators are sometimes used in an external wall. Describe thus :—

"Supply in scullery and servants' entrance corridor three (in all) Hayward Bros. & Eckstein's improved mica outlet ventilators No. 3, 11 in. by 9 in., with brass trellis front, and form openings through the external walls."

Arnott's ventilators are used as outlets fixed in communication with a flue carried up by the side of a smoke flue.

"Supply in library and billiard-room Arnott's ventilator with 11 in. by 6 in. Japanned bronze trellis front, and form opening in the special extract flue provided."

Ventilation of Wards.—The ventilation of hospital wards, work house wards, barrack rooms, &c., depends on the same principles, *i.e.*, inlet of fresh air without draught, and extraction either by mechanical means, the mere levity of the warm air or by the attractive power of heat.

Blackman Fans.—The mechanical means are by fans of the Blackman type worked either by steam or electricity, Howarth's ventilators and Boyle's ventilators depending on the wind, Galton's stoves, by which the heat in the flue from the stove causes an upward current in a flue enveloping the smoke flue, and by openings in the enveloping flue the vitiated air is drawn from the ward.

SHORING.

Shoring usually at Contractor's Responsibility.—Shoring is usually met by an ordinary clause which throws the responsibility for failure or damage upon the contractor.

Housebreaker shores incases of pulling down.—In cases of pulling down the housebreaker usually shores.

As it is necessary to do this work concurrently with the pulling down, it will be reasonable that he should do it, and that the architect should insist upon the deposit of a sum of money as security.

If the shoring is of great extent, or otherwise of an important character, the housebreaker selected should be a substantial and trustworthy man, or the deposit should be increased.

"Securely shore up the adjoining premises to the satisfaction of the architect. Strut up and centre the old window and door openings adjoining the party wall, make good any damage which may occur to the adjoining property by reason of insufficient shoring and support before the general contractor takes possession of the site, and pay compensation for any damage to persons or property consequent upon the pulling down or from neglect of shoring. The shoring shall be the property of the building contractor, who will remove it when directed."

Shoring for Restorations.—In cases of the restoration of buildings as in the failure of the tower of a church, of the arcade of a nave, or of a great arch, the architect will have to assume the responsibility and design of the shoring. He will prepare drawings and specifications of it as for any other structure.

Shoring often done Day Work.—This kind of work, if extensive, is so uncertain in its nature and so often requires a change from the first intention during its progress, besides the shifting and refixing of the timbers, that it is best conducted by selecting a trustworthy builder, and employing him at day work, on a schedule of prices charging the use and waste of the timber per foot cube, and the labour in its conversion, fixing and removal at an agreed price per hour of the various men working. This will not supersede the necessity of careful drawings and specification. The shoring being only a means to an end, the underpinning and replacement of the damaged work will probably be done as soon as the shoring is completed.

The schedule of prices should finish with a short form of contract. See Leaning's "Quantity Surveying," Section Schedules.

CONCRETE BUILDINGS.

Relative Value.—The use of concrete is generally an expedient for saving money. In the localities where gravel and sand suitable

for the purpose are near the site of the proposed building a saving is effected. When their use involves much carting the saving is small.

Work for which Concrete may reasonably be used.—For work in great masses like retaining walls, quay walls, sea walls, breakwaters, and the like, its cohesion without joints is an important advantage.

Finish of Concrete Walls.—In domestic buildings it is always necessary to finish the work externally with a Portland cement plain face, but internally one or two coats of plastering instead of three is a saving on the ordinary custom.

Its use as filling between two facings of a wall is countenanced by ancient practice, and has perhaps received in modern times less attention than it deserves.

Thick walls, like those of churches, may be concrete, faced on both sides with brick or stone, thus:—

"Build the walls to detail of cement concrete as shown, entirely of concrete up to the damp proof course, and above that with brick facing as described on each side of wall, set and pointed in cement, and laid Flemish bond, every third header in each course an entire brick, the others half bricks. These bonders shall not be in the same perpendicular line, but shall break joint."

For domes and floors concrete offers many advantages.

Concrete often as expensive as Brickwork.—Although theoretically concrete work is cheaper than brickwork, it often happens that a contractor wants as much per foot cube for it as for brickwork, and sometimes more.

Apparatus need not be specifically described.—It is not necessary to prescribe the apparatus to be used, it is better to leave that to the builder.

Parts built of Brick.—If any parts of the building are to be of brick they should be indicated by colour or described, or both.

FIREPROOF BUILDINGS.

If the concrete floor is laid by a special contractor, a clause must appear in the general contractor's specification.

"Make good and level up concrete as required to receive the flooring, also to float and set ceilings." Often dubbing is necessary.

Word "Fireproof" Misapplied.—Very few of the floors which are

described as fireproof are impervious to fire, but many of them will resist its effects for a long time.

A list of fire-resisting materials is given in the second schedule to the London Building Act, 1894.

Public Regulations as to Fire.—The theatre regulations of the London County Council provide for the protection of such buildings from fire. The London County Council also insists upon various precautions as to protection to and exits from assembly halls and other places of entertainment. During the winter many of the public swimming baths are fitted with temporary floors, and are used for concerts, balls, &c., and must conform to the regulations before mentioned.

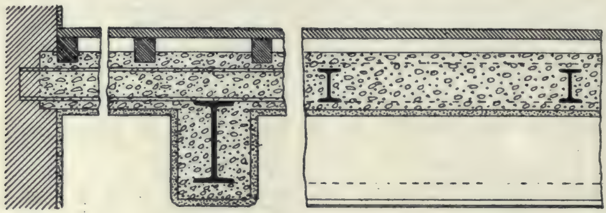


FIG. 124.

Principle of Fireproofing.—Iron and steel enter largely into the construction of a fireproof building, and the leading principle is to encase them in fire-resisting materials. For this purpose concrete or terra-cotta are the most convenient.

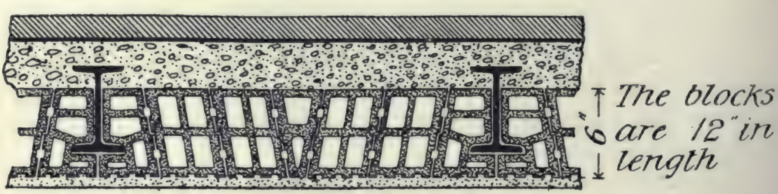


FIG. 125.

Simplest Fire-Resisting Floor.—The simplest form of fire-resisting floor (Fig. 124) is that of a flat plate of cement concrete or breeze concrete, and supported by iron or steel joists and girders as sketch. The steel or iron would be described as a part of the general contractor's work, or would form part of a sub-contract for structural ironwork. The concrete would be described in the work of the general contractor. (See Clause.)

An additional precaution is the casing of the girders with concrete. (See Clause.)

Doulton-Peto System.—The Doulton-Peto system, as Fig. 125, is a good one. The metal work may be dealt with in the general contract, or form a part of a sub-contract as before. The terra-cotta and its fixing, and the concrete, may be included in the general contractor's work. There are three depths, 6 in., 8 in., and 12 in. State which is required. Describe as follows :—

"Construct the floor of the laundry with the Doulton-Peto fire-proof flooring, 8 in. thick, jointed and grouted with Portland cement. Lay thereon coke breeze concrete as described, of a thickness sufficient to cover the top flanges of the steel joists 1 in. thick. For cement paving and ceiling beneath, see Plasterer."

In Plasterer.

"Render and float the underside of the Doulton-Peto floor with Portland cement, and do any necessary dubbing to receive it."

Lindsay's System.—Lindsay's steel trough decking (Fig. 126) is best laid by the patentee. The girders may be described as

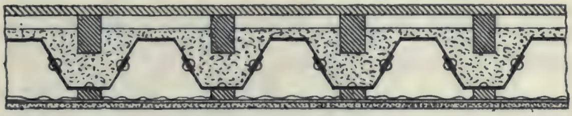


FIG. 126.

a part of the general contractor's work, or they may form a part of a sub-contract. The concrete would be described in the work of the general contractor. Describe thus :—

"Construct the floor of the printing office with Lindsay & Co. (South Wharf, Paddington) steel trough decking of $\frac{5}{16}$ in. metal maximum **0** carefully riveted together, and cut and fitted to the girders, the work to be supplied and fixed by the manufacturers."

Or a special contract may be made with the manufacturer; for this add a sum included as provision thus :—

"Provide for 540 ft. of Lindsay's steel trough decking and fixing £ ."

In Painter.

"Paint the whole of the steel decking on both sides with two coats of Calley's Torbay paint, the whole to be cleaned from rust and scale before painting."

In Excavator.

"Fill in over the steel troughing of printing office floor with coke breeze concrete as described of depth sufficient to cover the tops of the troughs 1 in."

In Carpenter.

"Form ceiling beneath the printing office by bolting to the

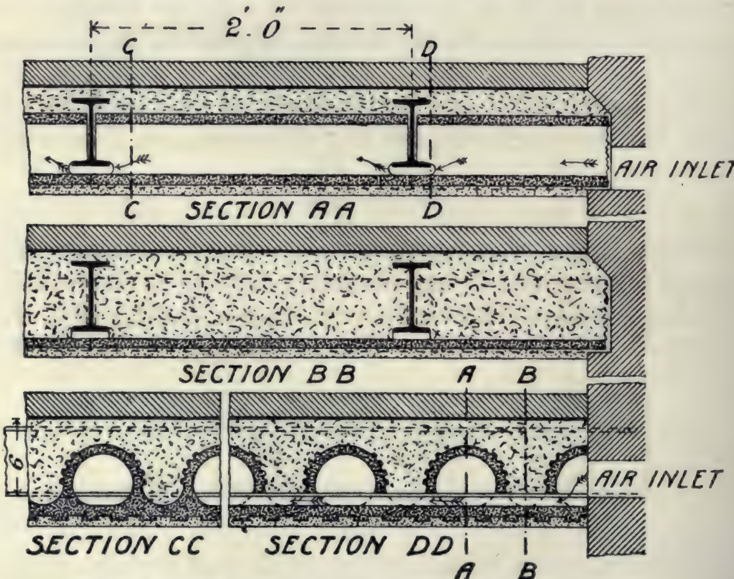


Fig. 127.

steel decking with $\frac{3}{8}$ in. bolts 2 ft. apart, 3 in. by $2\frac{1}{4}$ in. ceiling joists about 12 in. from centre to centre."

In Plasterer.

"Lath plaster float and set all ceilings and soffits."

Fawcett System.—The Fawcett floor (Fig. 127) has been used in some important buildings in various parts of the kingdom. The iron or steel work in girders may be described as a part of the general contractor's work, or may form a part of a sub-contract. The terra-cotta and its fixing and the concrete may be included in the general contractor's work. Describe as follows:—

"Construct the first, second and third floors of warehouse with Fawcett's (50, Queen Anne's Gate, Westminster) patent tubular

lintels, laid diagonally and accurately, cut and fitted where required."

"Fill in above the lintels with coke breeze concrete as described of sufficient depth to cover the top flanges of the steel joists $1\frac{1}{2}$ in. thick."

Dennett and Ingle System.—Dennett and Ingle's system of flooring (Fig. 128) is laid by the patentees. The metal work may be described as a part of the general contractor's work, or may form a part of a sub-contract.

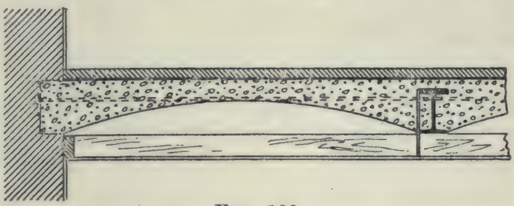


FIG. 128.

The Dennett arch may be included as a provision. Oversailing courses or chases where the work adjoins walls will be formed by the general contractor. Describe thus:—

"Construct the floor of vestibule and the whole of corridors of ground floor with Dennett's (Dennett & Ingle, 5, Whitehall, London, S.W.) fireproof arching, for which a sum is provided. (See Provisions.) Specify thus:—

"Provide for 320 yards of Dennett arching £ ."

"The patentees will supply centering and all materials and labour, but the general contractor shall supply, erect, alter, and remove scaffolding and ladders, and will supply water."

The foregoing illustrates the principles of treatment, but there are many more systems in use. Perhaps the greatest variety has been used in America, where, as in New York and Chicago, the great height of the buildings, and the large proportion of metal in such structures increase the importance of precautions against fire. Several of these systems are illustrated and described in Birkmire's "Planning and Construction of High Office Buildings," Chapman & Hall, 1898.

In all cases, before specifying the work, the architect must make himself familiar with the construction he proposes to adopt, and settle what parts of the work shall be done by the general contractor.

The Monier System.—The Monier construction, the principle of which is the combination of Portland cement concrete with steel in such a manner as to develop in the same material the high resistance to compression and binding of the former, and the

great tensile strength of the latter. In such a combination the good qualities of both materials are retained, and no chemical action occurs between the iron and the moisture in the concrete. The concrete adheres firmly to the smooth surface of the metal, and the co-efficients of expansion of the two constituents are for all practical purposes identical. The economy of the system in the construction of girders and arches is considerable owing to its great strength and compactness, and its fire-resisting qualities are very great.

Large spans may be used for floors, and the small amount of head room required is a factor of great value.

The comparative strength of the construction is also exceptional. Modifications of the principle are coming into use by fire-proof specialists with increasing frequency.

As before the steel or iron may be described as a part of the work of the general contractor, or may form part of a sub-contract for structural ironwork. The concrete may be described and included in the general contract. A few simple examples of the treatment of this construction are as follows. Observe that coke breeze concrete is not strong enough and is moreover porous, but it may be used for filling in spandrils of arched construction.

In Excavator.

"The cement shall be of approved quality and manufacture, and when mixed in the proportion of one of cement to three of clean washed sand briquettes which shall be prepared and tested

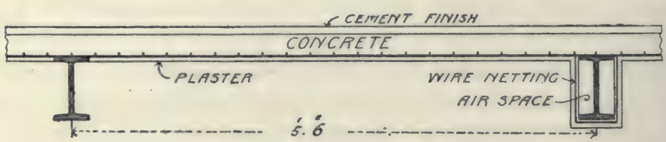


FIG. 129.

shall bear an average tensile strength of 200 lbs. per square inch seven days after their making, and 300 lbs. per square inch twenty-eight days after their making."

"The ballast shall be Thames ballast, clean and free from all foreign substances and impurities, passed through a sieve with $\frac{1}{4}$ in. mesh, and retaining on a sieve with 400 meshes to the square inch of 50 per cent. of its bulk."

"Lay over the whole surface of the floor on the steel joists (Fig. 129) provided hard steel wire rods $\frac{5}{16}$ in. diameter, arranged

to cross each other and form a $2\frac{1}{2}$ in. square mesh, each transverse rod to be tied to each alternate longitudinal rod by thin wire of sufficient strength to keep them at their proper distance until the concrete has been deposited. The netting to be kept up $\frac{1}{2}$ in. from the centering, and the joints of the rods to pass at least $1\frac{1}{2}$ in."

"Lay the floor of concrete 3 in. thick, compounded of one volume of cement to six volumes of ballast, both as above

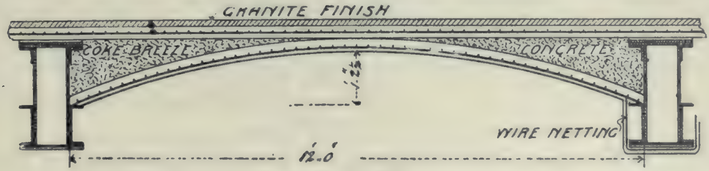


FIG. 130.

described, all over the floor on the centering so that the netting is completely enveloped; the concrete shall be well rammed on the centering."

"Finish the surface with 1 in. Portland cement paving floated and finished with a trowelled surface in pure cement."

"Dubbing should not be required, but dub if necessary and render with coarse and float in fine plaster-of-Paris."

For Fig. 130, cement, ballast, and concrete, as described for last example.

"The breeze concrete shall be composed of 1 part of Portland cement, 4 parts of clean ballast stones, to pass $1\frac{1}{2}$ in. ring, and 2 parts of coarse well screened coke breeze."

"Lay on the arched centering longitudinally hard steel wire rods $\frac{5}{16}$ in. diameter, and transverse rods $\frac{1}{4}$ in. diameter, arranged to cross each other and to form a $2\frac{1}{2}$ in. square mesh, each transverse rod to be tied to each alternate longitudinal rod by thin wire of sufficient strength to keep them at their proper distance until the concrete has been deposited. The netting to be kept up $\frac{1}{2}$ in. from the centering, and the joints of the rods to pass at least $1\frac{1}{2}$ in."

"Lay the arch of concrete 3 in. thick, compounded of 1 volume of cement to 6 volumes of ballast both as above described, well rammed on the centering so that the netting is completely enveloped."

"Fill up the spandrils with breeze concrete as described. Carefully level the breeze concrete, and lay thereon longitudinal,

and transverse rods and cement concrete 3 in. thick, as before described, for the whole area of the floor."

"Finish the surface with paving, floated and trowelled, $1\frac{1}{2}$ in. thick composed of $2\frac{1}{2}$ parts of small granite chips, average size $\frac{1}{2}$ in. by $\frac{1}{4}$ in., of smaller chips $\frac{1}{2}$ a part of granite dust, and 1 part of Portland cement, the surface floated and trowelled in the same operation, with a mixture of 2 parts of granite dust to 1 part of Portland cement."

"Each layer of concrete shall be protected from dust and kept clean, and before the deposit of the next layer the surface of the former layer shall be watered."

"Dub the soffits of the arches if required, and render with coarse and float with fine plaster-of-Paris."

Wooden Floors on Fireproof Construction.—Tile, cement, or wood block floors require no comment; they will be laid on the concrete in the ordinary way. Boarded floors are sometimes laid directly on the concrete and nailed to it, but the practice is not to be recommended; it is better to interpose bearers. Specify thus:—

In Carpenter.

"Form chases in the concrete floors, while wet, where described to be boarded, and bed therein $4\frac{1}{2}$in. by $2\frac{1}{2}$ in. fir joists of dovetailed section, let in about $1\frac{1}{2}$ in. and 12 in. apart, to receive the boarded floors."

Protection of Metal Stanchions and Columns.—The protection of metal stanchions and columns is mostly disregarded, but in a fierce fire they are a dangerous element of failure. The ordinary practice is the bedding of the metal in concrete and plastering, or concrete and terra-cotta. Specify as follows:—

"Embed the stanchions supporting the floors in breeze concrete as described, and as shown on detail No. 20. Finish with a plain face 1 in. thick in fine plaster-of-Paris."

Or,

"Envelop the stanchions supporting the floors with thoroughly burned terra-cotta $2\frac{1}{2}$ in. thick in the thinnest part, jointed and chambered as shown on detail No. 30, and the back of the terra-cotta kept 1 in. away from the metal, all to be set in cement, and the chambers of the terra-cotta and the spaces between it and the iron filled in with fine cement concrete."

Or,

"Envelop the stanchions supporting the floors with fine cement concrete, as shown on detail No. 40. Finish with fine plaster, plain face 1 in. thick. Cover with No. 1 mesh $\frac{3}{8}$ in. metal fire-proof lathing (Expanded Metal Co., 39, Upper Thames Street), secured by lengths of galvanized iron wire passing through the last-mentioned concrete, and wrapped round the stanchions; finish with fine plaster on a backing of Portland cement."

In columns for fire-resisting buildings metal of not less than a thickness of $1\frac{1}{8}$ in. is advisable. Ventilation through the columns is also an assistance. The resistance of hollow cast-iron columns is superior to that of ordinary wrought iron or steel stanchions.

Recent trials by fire appear to show that casings of the Monier construction or of patent Korkstein, made of asbestic silicious marl and of asbestic cement, exhibit great power of resistance.

Coke Breeze Partitions.—"The whole of the partitions on first and second floors shall be 6 in. thick of coke breeze concrete as described. Each door opening shall have two lintels of 2 in. by 2 in. angle steel 12 in. longer than the width of opening."

ALTERATIONS AND REPAIRS.

Mistaken Retention of Old Work.—Work of this kind requires more care and judgment in the architect and the specification writer than any other part of their work. The architect in such a case is often embarrassed by the obstinacy of the building owner who persists in retaining almost useless parts of the old building to the damage of the design and the increase of expense. Sometimes the architect is in fault, and decides to alter and maintain pieces of floor or small pieces of wall, which it would be cheaper to demolish.

Clearing Site of an Old Building.—Use of Old Materials.—In the case of the entire clearing of a site the architect must decide whether the work shall be done by a house breaker or the general contractor, who shall do the shoring, whether any of the old materials shall be reused or not, and if they are, which portions. As a rule, only the sound old bricks or stone should be used. Old timber is dangerous, from the liability to dry rot. Old joinery either hampers the design, or is spoiled before the building is ready to receive it. Other materials are hardly worth consideration.

Considerations in the Alteration of a Building.—Other points for consideration are the order of pulling down, the order of rebuilding, the arrangements necessary for the carrying on of a business or the teaching and routine of a school during the alteration of the building or the drains, the maintenance of a right of way, the enclosure of parts of a building during the remodelling of the remainder, the protection of the old work and the adjoining premises, the erection of temporary w.c.'s, temporary drainage, &c., the selection of materials which shall be least conspicuous in an addition, such as using Luton bricks for facing. These are but a few of the points which press for solution.

PUBLIC BATHS.

The special features of these buildings are specified in a separate section. A great number of these establishments have been erected within the last ten or fifteen years, and as the movement is extending the specification of such buildings is interesting for the specification writer. The specification should provide for durable materials and substantial construction. In the earlier movement economy of construction was a leading principle, but some of the more recent buildings have been very expensive.

Apportionment of the Work.—The ordinary building work is usually the work of a general contractor, but the hot and cold water supply, the boilers, engines, and heaters, and their fixing are usually the subject of a separate contract, and the sum included as a provision, the general contractor preparing the engine beds and supplying the materials for the setting of the boilers, and building the trenches for hot-water pipes, the sumps, blow-off pits, &c.

The cutting away and attendance will be of considerable extent, and may be done either by the engineer or the general contractor.

Apportionments of a Laundry.—When a public laundry is part of the establishment the apparatus, as engine, appliances of drying closets, hydros, washing troughs, mangles, ironing tables, &c., are usually the subject of a separate contract, and the sum included as a provision. The general contractor prepares the engine bed, the recesses and pits beneath them for the reception of the ironwork of the drying closets, the

foundations for the hydros, the wastes for the washing troughs, and the drains therefrom.

The cutting away and attendance may be done either by the engineer or the general contractor.

Engineering Sub-contractor to Furnish Drawings and Description of his Work.—It is the usual practice for such sub-contractors as these to furnish a statement and drawings of what they propose to do, and they will show the architect what work he should specify to be done by the contractor.

Wooden Enclosures.—When wooden enclosures are used, they, as well as all the other internal painted work, should be varnished, but often the divisions are made of thin, glazed, special bricks, slate, or even marble. Tiltman's bricks are thus specified :—

Enclosures of Special Bricks.—"Construct the enclosures of men's and women's first-class private baths with Tiltman's white, glazed, registered partition bricks, built in cement, raked out and neatly pointed with red mortar. Support these partitions by piers of similar bricks, 9 in. long, 9 in. high, and about 2 ft. 3 in. apart, and galvanized channel iron, $3\frac{1}{2}$ in. by $1\frac{1}{2}$ in., running the whole length of the partitions. The front partitions shall rest on the floor."

"On the bottom course and top course, and every sixth course in height, lay in these partitions two rows of No. 12 B. W. G. galvanized iron wire, lapped together at angles, secured to the door frames by galvanized iron staples, and running into main walls, and lapped around a 9 in. length of hoop iron $4\frac{1}{2}$ in. within face of wall."

"The external and internal angles of these partitions shall be bull-nosed."

"Finish these partitions at top with half round coping (Fig. 131) to match the partition, the angles and intersections to be solid and purpose made, and the ends next main wall to be also solid, with the rounded part stopped on a brick 9 in. long, flush with face of wall. The coping of the door heads shall be of wood to match the brick."

FIG. 131.

Slate Enclosures.—The slate partitions, which sometimes have slate doors, are both specified thus :—

"Construct the enclosures of men's and women's first-class private baths with 1 in. Bangor slate slabs, rubbed and sanded both sides, those to divisions and ends to be not less than 3 ft.

in width, rebated together, and jointed in oil mastic cement, the slate between the doorways to be in single slabs, the divisions and ends, when they run up to walls, to be pinned in 2in. Finish the slate at top with finely cast-iron capping, as sketch (Fig. 132), and of $\frac{1}{2}$ in. iron, the ends pinned into walls 4 in., and in as long lengths as possible, carefully fitted at intersections, and with $\frac{3}{8}$ in. wrought iron plate (Fig. 133) laid over the joint, and screwed with six screws with countersunk heads, as sketch. Secure the slate to floor by galvanized shoes of $\frac{1}{2}$ in. iron, 5 in. by $3\frac{1}{2}$ in. by $1\frac{1}{2}$ in. bedded in the concrete, and about 2 ft. apart, as sketch (Fig. 134)."

FIG. 132.

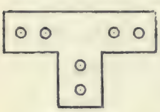


FIG. 133.

"Connect each of the slate fronts with each slate division by two 2 in. stout copper screws and lead plugs, the heads of the screws to be countersunk."

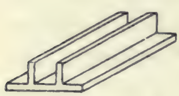


FIG. 134.

"The doors to be 2 ft. by 6 ft. 3 in. of 1 in. slate, to match divisions, with all the edges rubbed and sanded, one edge rebated to fit a rebate in the slate slab of front. Hang with a $\frac{3}{8}$ in. wrought iron top plate, 4 in. by 3 in., as centre, and screwed with two screws on top of capping, the capping to be increased in width to receive it. Fix in top of each door $\frac{3}{4}$ in. diameter steel pin 2 in. long, with pointed end to work in a hole in the plate last described."

"Fix to the bottom of door a $\frac{3}{8}$ in. gun-metal plate $6\frac{3}{4}$ in. by 3 in. extreme, with projecting socket as hinge fixed with three stout copper screws with countersunk heads to lead plugs in door, and with hole to receive a $\frac{3}{4}$ in. steel pin 2 in. long as pivot, tapped into one of the cast-iron shoes before described."

"Fix on each door and partition with brass screws and lead plugs a brass spring latch and catch, P. C. 5*s*. exclusive of fixing."

"Supply to each door a 2 in. strong solid brass-bronzed knob with strong brass screw passing through the door and secured by a nut; also a 4 in. oval porcelain tablet with number, and screwed with two screws to lead plugs in the door."

Bath Compartments without Doors.—Sometimes the dressing compartments of swimming baths have no doors. The divisions of brick, and each compartment fitted with a seat, a rack for clothes, and a footboard, as sketch (Fig. 135), describe as follows:—

"Construct the divisions of dressing boxes in second-class

swimming bath of best white glazed bricks set and pointed in cement, all stretchers. Finish the tops of partitions with rounded capping of semi-circular section, and the vertical edges with semi-circular ends."

"Fit each compartment with 1¼ in. deal wrought both sides, seat with rounded nosing on 2 in. by 1½ in. chamfered bearers, and a deal rack of 3 in. by 2½ in. top and bottom rail, chamfered on exposed arrises and pinned into the partition, and 1¼ in. by 1¼ in. balusters 6 in. apart and slightly housed at ends."

Scum Troughs.—These are fixed a little above the water level,

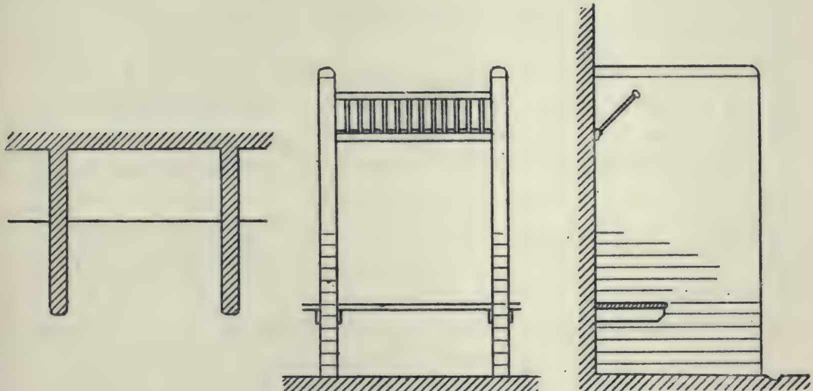


FIG. 135.

and the movement of the water throws the scum into the channel.

Sometimes projections are formed at intervals to serve as spittoons.

Steam Engines, Boilers, and Heating. — Engines are usually described from a trade list, stating whether vertical or horizontal, the nominal horse power, diameter of cylinder, and length of stroke, and whether it includes any extras, as feed pump, feed-water heater, or any parts in duplicate.

All the manufacturers illustrate their engines in a trade list, and many of them designate each type of engine by a code word.

CHURCHES.

Materials and Construction should be Liberal.—Obviously the ordinary rules of construction apply to these as to all other

buildings. Dignity demands that the walls should be thick, the materials good, their use liberal, and the construction substantial. Many of the chapels of the Nonconformist sects are examples of what to avoid.

Submission of the Documents to Authorities.—The specification, instead of being written after the preparation of the quantities, will nearly always be written before that work is done, as both specification and drawings will be submitted to the Ecclesiastical Commission, possibly to the Commission of Queen Anne's Bounty, and possibly to the Bishop of the Diocese. Before writing the specification the submission of the drawings to the surveyor to the local authority in a country district, or to the district surveyor if in London, will save trouble.

Provisions.—The specification of a church commonly comprises many provisions, as for carving in wood and stone, paving, stained glass, heating and ventilation, gas, gas fittings, bells.

Separate Contracts.—Often the stone quarry is worked, and in such case sometimes a separate contract.

Expensive fittings, as highly finished choir seats, pulpit, &c., are sometimes separately contracted for with a specialist in such work.

Precautions.—Special building precautions will be necessary in the case of rebuilding in an old churchyard, and the terms of the faculty must be observed.

The deposit and reinterment of bodies, and the disposal of the earth will require particular attention.

The Act to prevent building on disused graveyards should not be forgotten (Disused Burial Grounds Act, 1884).

Restorations.—In the specification for the restoration of a church the old materials to be used should be specifically described, their deposit and protection, also the numbering of old stones to ensure identification, the disposal of old materials not required for future use, the protection of monuments, fonts, &c., the similarity of new materials and workmanship to the old. A provision of ironwork in straps and bolts is a wise precaution.

SCHOOLS.

Buildings of the School Board for London.—The buildings of the School Board for London furnish examples of various types of

schools, which have largely affected the design of buildings of this kind throughout the kingdom.

Submission of the Documents to Authorities.—The specification and drawings will be submitted to the Education Department before the preparation of the quantities.

The drawings should be submitted to the surveyor to the local authority in a country district, or to the district surveyor if in the London district, before the specification is prepared.

Provisions.—The specification of a school often comprises many provisions, as heating, ventilation, gas, gas fittings, paving of playgrounds, &c.

Special Work in Schools.—Children's galleries, sliding partitions, cloak rooms, are special works which occur in buildings of this kind. The lavatories and w.c.'s will be in ranges, the stairs will be subject to much wear, and the steps must be specially hard. Where there is a laboratory the fittings will be a part of the general contract, and they should be made of hard wood, preferably of teak.

Several manufacturers supply sliding partitions; some are patent. They may be treated as a provision, with the usual precautions as to defining what the provision includes. Their use is not to be recommended. Separate class-rooms are more in accordance with modern requirements.

Self-coiling shutters are sometimes used for the same purpose as sliding partitions.

HOSPITALS AND LUNATIC ASYLUMS.

Submission of Documents.—The drawings and an approximate estimate are submitted to the Local Government Board, and generally the writing of the specification is deferred until the quantities are taken out.

The drawings are submitted to the surveyor of the local authority if the building is in the country and to the district surveyor if in London, and the writing of the specification may be deferred until after their approval.

Provisions.—The specification of a hospital commonly comprises many provisions as for heating and ventilation, gas and gasfittings, electric lighting, structural ironwork, boilers, engines, destructors, laundry fittings, paving of courts, road making, kitchen fittings, operating table, padded rooms, ovens.

Ventilation.—The ventilation will require particular attention. Often the heating and ventilation of the wards is combined in the Galton stove or some similar appliance.

Escape Stairs.—When the design includes wards on an upper floor iron escape stairs will be necessary.

Precautions.—The prevailing impulse of lunatics to suicide should be remembered, and any projections to which a rope or a handkerchief might be attached should be avoided as much as possible, as pegs or hooks, rails, lines and pulleys, &c. Waste-preventing cisterns and their pipes should be securely cased.

THEATRES.

Submission of Documents.—In London the drawings and specification will be submitted to the clerk to the council, in the country to the surveyor to the local authority.

London County Council Regulations.—The specification must accord with the regulations of the council, 9th February, 1892, with respect to the requirements for the protection from fire of theatres, houses, rooms, or other places of public resort within the administrative county of London.

Provisions.—The specification of a theatre commonly comprises many provisions as for heating and ventilation, gas, gasfittings, electric light, electric fittings, decoration, structural ironwork, limelight tanks, boilers, engines, dynamos, upholstery, &c. Not infrequently the foregoing are made separate contracts.

Stage.—When the stage involves much mechanical work it is usually done by a specialist.

UNDERGROUND CONVENIENCES.

Suggested by Mr. George Jennings.—These structures, first advocated by the late Mr. George Jennings, a well-known sanitary enthusiast, for years before they were adopted, have now come into general use, and are a very marked public improvement.

Their general arrangement is like the sketch (Fig. 136).

They are nearly always designed and superintended by the surveyor to the local authority, but as their use is not confined to vestries and boroughs they may be briefly described here.

Work should be of Good Quality.—As they are of the nature of

public buildings the materials and workmanship should be of the best quality for utility and strength.

The brickwork should be in cement, and for the sake of cleanliness all the exposed faces thereof should be glazed. The floors should be of tile or mosaic, and every material should be of a nature to bear frequent washing. To this end all partitions and divisions should be kept clear of the floor. The steps should be of the hardest material, as the traffic is great. If of stone the hardest York; but even these should be protected by "silicon" (Doulton), hardened steel, or Hawksley's patent treads. The other stone used should be Portland, or a stone equal to it in hardness and durability.

Accommodation.—The accommodation will depend upon situation and population, and should always provide for an attendant. The w.c.'s may either be used by direct payment to the attendant,

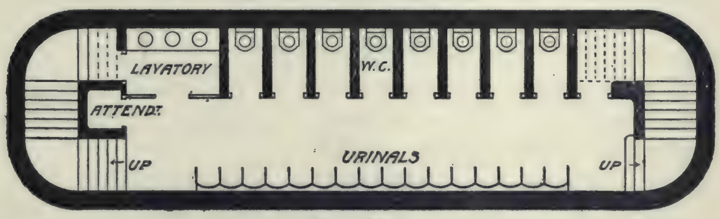


FIG. 136.

or the doors may have locks with slots for the receipt of the money of the user.

Sanitary Apparatus.—The sanitary apparatus should be of good quality, easily kept clean, and the simpler its construction the less liable is it to get out of order.

Urinals.—The urinal ranges are best made of enamelled fireclay, and the fewer the joints the better.

Automatic Flushing.—The flushing of the apparatus should be as far as possible automatic.

SHOP FRONTS.

Their Object.—The variety of shop fronts is considerable, but they are nearly all designed for one prime object—the display of the shopkeepers' wares. Artistic fitness does not commend itself to the retail trader, nor is he offended at the appearance of a

heavy superstructure apparently supported by great sheets of glass.

Materials.—The sashes and fascias are generally of hard wood, the remainder deal. The shutters may be of iron, steel or wood, and self-coiling, wooden lifting shutters are now rarely used. Sometimes a light iron movable railing is substituted for shutters, and very often this also is omitted.

Glass.—The glass may be plate or sheet. The latter is not so often used because of its limited length.

Before drawing or specifying a shop front or counter it will be reasonable to inquire of the building owner as to any special requirements.

Access to Shutters.—Either the fascia or a casing in the shop should be made movable for access to the shutter coil, and the blind box should also be partly removable.

Provisional Work.—The sun blind and shutter are best treated as a provision, a price having been previously obtained from makers selected by the architect. The manufacturer's offer should state clearly in writing what he intends to supply, and whether the price is net or includes a percentage for the builder, and the description may be adopted.

Lifting Shutters.—Lifting shutters may be thus described:—

"Supply 1¼ in. bead flush and square lifting shutters three panels high in about 15 in. widths, rebated and beaded at their edges, and each fitted with two 1¼ in. wrought-iron rebated shoes, and a set of iron stub and plates. Fit one shutter with a ¾ in. screw bolt of sufficient length to pass through the doorpost, and fit it with a butterfly nut and a 3 in. iron sunk lift."

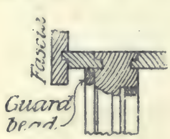


FIG. 137.

Observe that the lower edge of the fascia must be brought down (Fig. 137) 1 in. or thereabout to form a groove for the shutters, and the stall-board capping increased in width and protected by an iron plate let in flush and screwed with screws with countersunk heads.

Coiling Shutters.—"Supply and fix to the goods entrance a best quality steel curvilinear lath revolving shutter to work with best screw gearing, and iron grooves of extra depth fixed just inside the curve of the bull-nosed jambs and screwed to the bearers hereafter described. The shutter shall include best screw gearing and bearing brackets, the holes of which shall be bored out to

allow of gun-metal bushes being fixed therein. Supply extra strong shafts for the shutters to roll upon and all other necessary apparatus and appurtenances of the best quality for opening and closing. The whole of the gear shall have ample facilities for readily oiling and keeping in order."

"Supply and build in on the inside of the opening ten wrought-iron lugs (Fig. 138), five on each side, plumbed up truly to form fixing for shutter grooves, each made of a length of 3 in. by $\frac{1}{4}$ in. bar iron 6 in. long, the end split and turned up square and the corner cut off as sketch."

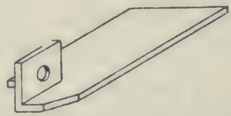


FIG. 138.

"Supply an iron cover (No. 14 B. W. G.) for the lower part of the gearing with a hole for handle."

"Enclose the shutter coil for its whole length by a case of similar wrought iron, each edge stiffened with a strip of 1 in. by $\frac{3}{8}$ in. iron riveted on, and fitted for removal to $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. rolled angle steel bearer fixed at end, and to two intermediate mullions of similar steel riveted or screwed to the angle iron of door head and pinned to the brickwork of the arch. The lower edge to be fixed to 3 in. by 3 in. rolled angle steel with cranked ends pinned into the brickwork of jambs. Stiffen this casing at ends and at two intermediate points with 1 in. by 1 in. by $\frac{3}{16}$ths angle steel, curved to the casing and riveted thereto. Cut off the web of the intermediate supports. Partially enclose the ends in a similar way. The whole of the foregoing casing to be fitted with thumb or bolt-head screws for easy removal."

Enclosure of Show Board.—When the contract includes the enclosure of the show board it may be described as follows:—

"Enclose the show board for a height of 2 ft. by $1\frac{1}{2}$ in. framing to detail, one panel high, moulded and rebated for glass, and with movable mouldings fixed with brass screws and cups. The salient angles to be moulded, rebated, and grooved together."

"Fit three panels as doors, hung with 3 in. brass butts, and both door and framing rebated and beaded all around. Fit each panel with a 2 in. by $1\frac{1}{4}$ in. brass show case latch, with ebony knob."

"Cover the whole area of the show board with similar framing, projecting over the enclosure last described $1\frac{1}{2}$ in., and with 2 in. by $1\frac{1}{4}$ in. bed moulding, rebated on upper edge and let into groove."

"The whole to be in Tabasco mahogany, French polished."

In Glazier.

"Glaze the enclosure of show board with British polished plate glass as described."

PUBLIC-HOUSES.

Submission of Documents.—The specification should not be prepared until after the drawings are submitted to and approved by the justices.

The chief characteristic of these buildings is garish and extravagant decoration.

The front of the ground floor is distinguished from other shop fronts by several entrances, and often more glass and gasfitting, but in other respects resembles them in general character.

The specification of the joinery of the ground floor and the counter requires some knowledge of tavern arrangements, but except for these the ordinary knowledge of building is sufficient, and the work is specified in the ordinary way.

Joinery.—The fittings are generally of mahogany, but teak or wainscot are not rare. When hard woods are beyond the means of the building Sequoia, pitch-pine polished or stained and varnished, or white wood stained to imitate mahogany, and French polished, is possibly substituted.

Estimates for Public-house Work.—The ordinary estimate for a public-house is often largely composed of provisions. These buildings are often designed by auctioneer's clerks, or comparatively ignorant nominees of a public-house broker. As a consequence, much of the decoration is the production of the professional decorator or the public-house fitter. The latter often does the cabinet, the counter and its fittings, pewtering, beer engines, &c., and in many cases all the ground floor joinery. The ground floor glass being either embossed plate, brilliant cut plate, or lead lights is also a provision, as is also the gasfitting or electric light, the mosaic or tile paving, and the upholstery of benches and the like. It must, however, be admitted that some of the more recent buildings of this class are exceptionally well built and of truly artistic design.

Entrances.—The entrance doors should have swing hinges to ensure their shutting. The old fashion, which is becoming obsolete, was to fit them with leather straps and lance-wood

springs, so as to keep them partially open. They were described thus:—

"Fit each entrance door with a set of lance-wood spring, stout leather strap and heavy brass buckle, with wrought staples and plates screwed to door and frame."

In the modern houses the entrance doors are not external, but are entered from an open lobby with a Bostwick gate or revolving shutter next the street.

Pewterer's work, beer engines, spirit taps, &c., are generally treated as a provision. If not, something like the following are the clauses required:—

Pewterer and Bar Fitter.

Materials and Labour.—The whole of the materials and workmanship to be of the best quality, and the whole of the fittings of London manufacture.

Plating.—All mounts, spouts, cocks, bosses, and all other work described to be silver plated on German silver.

Beer Engine.—Supply one eight-pull beer engine with stoutest brass slings and levers, ebony handles, silver-plated bands, mounts, and spouts, the handles to be fixed flush with the mahogany counter top, $8\frac{1}{2}$ in. from centre to centre, and each pull to draw half a pint at a time.

Supply substantially made case for engine with mahogany shelves and veneered sink.

Lay on supplies from cellar to engine with $\frac{3}{4}$ in. strong lead pipe, tapping cock, union, and ceiling screw to each pull.

Spirit Cocks.—Supply two sets of eight plated spirit cocks and bosses, fixed to and including 4 in. by 1 in. Cuba mahogany rails, shaped at each end and securely fixed to the counter. Lay on supplies from spirit room on first floor to each cock with $\frac{7}{16}$ths tin pipe.

Refrigerators.—Under each set of spirit cocks to the whole width of cupboard put $1\frac{1}{4}$ in. deal ice box lined with lead, with brass washer and plug, and $\frac{3}{4}$ in. lead waste pipe to deliver over gulley in basement. Fit the box with oak perforated shelves and stout baize.

Pewtering.—Cover the sub-counter with polished pewter $3\frac{1}{2}$ lbs. per foot, turned up against vertical faces 6 in., finished with beaded edges. Carefully dress the pewter over edge of counter and into the perforations for basins.

Line the sink of beer engine with similar pewter. Fit with hard metal loose rod drainer.

Drainers.—Put where shown three hard metal circular basins in sub-counter top 11 in. diameter, 8 in. deep, with double bottoms, brass supply cocks, washer, plug and chain, and 1 in. lead waste pipe. Put hard metal diamond "savealls" under each set of spirit cocks.

Supplies.—With ½ in. strong lead pipe and ½ in. bib cock from nearest supply lay on the water to each basin.

Funnel Pots.—Supply on each side of set of spirit cocks sunk pint funnel pots and funnels.

COLD STORAGE. (Fig. 139.)

Necessity for Cold Storage Accommodation.—The steady increase in the imports of perishable food and the necessity of its protection from damage has encouraged the development of various systems of cooling and insulation. Meat, fish, milk, butter, cheese, beer, eggs, fruit, are the chief commodities.

Objects of Cold Storage.—The ordinary ice chest and the refrigerating chamber have been used as adjuncts to a large house or a club for a great while. The larger buildings are of comparatively modern institution. At the abattoirs where foreign cattle are slaughtered shortly after they are landed, it is necessary to cool the carcases rapidly previous to their despatch to various parts of the country. In Australia, New Zealand, and the Argentina, flocks and herds are slaughtered close to the pastures in which they are reared, immediately subjected to the freezing process, packed in insulated railway carriages, transferred to refrigerating chambers on board ship, removed on arrival in Europe to insulated lighters or trains, and deposited in cold storage buildings pending their distribution to the purveyors.

Refrigeration.—Refrigeration by machine is gradually becoming an important factor in the business of the country. Such machines are used in skating rinks, chemical works, dairies, food stores, breweries. They afford important assistance to the dairyman, the makers of chemicals, gelatine photographic films, ice, and chocolate.

Requirements.—The requirements of a building for refrigeration

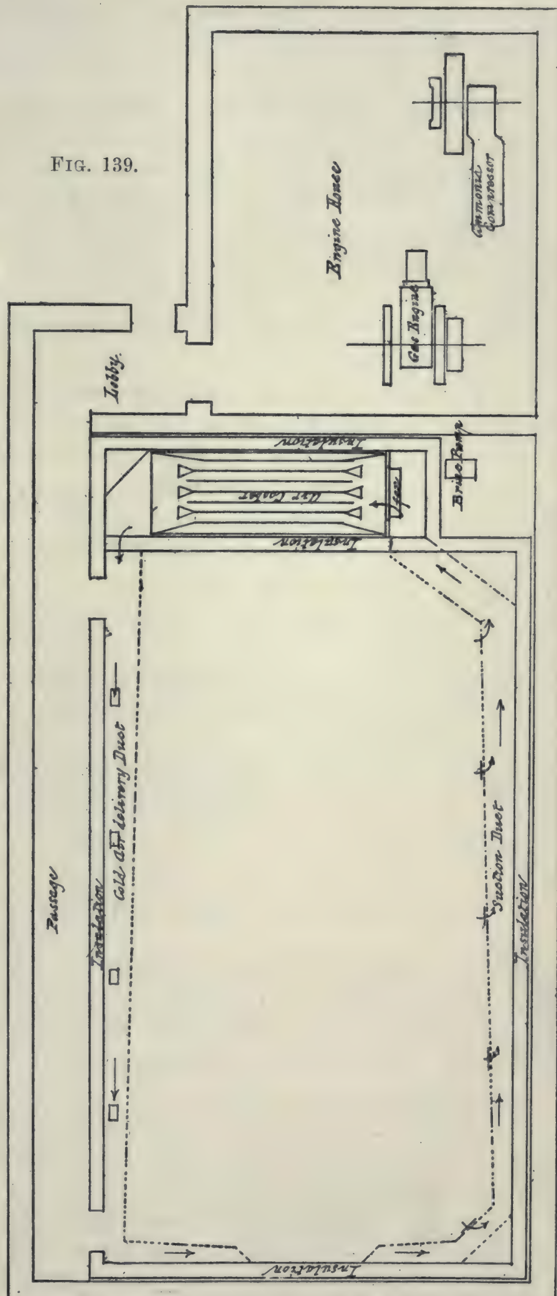
or cold storage are a cold-air machine to produce a low temperature, and a building which shall be as nearly as possible a perfect insulator.

As cold air sinks by its own weight the machine which generates it should be kept as high in relation to the cubic contents of the building as possible, and this is met in many cases by constructing the building mainly below the general surface of the ground.

Systems.—The machines in use, and consequently the systems, are various. One is the dry-air system of Messrs. Haslam, of Derby.

The Linde

FIG. 139.



refrigerating system (35, Queen Victoria Street, London), a combination of an ammonia engine with brine coolers, is perhaps the leading one in use, as its machinery may be placed in the basement of a building, the cold air being pumped into chambers at the top of the building and distributed by gravitation.

Besides these, the De la Vergne ammonia machine, with brine conveyors in the chambers, and the Hall carbonic-anhydride system, are in use.

The contract with the engineer should involve a guarantee to maintain a certain temperature. This may vary between 25° and 45° Fahr., and the power required will depend upon the size of the building.

The conclusions derived from experiments are that a storage chamber to maintain low temperature should be without openings in the sides, the openings being provided only in the top floor.

Insulation.—The insulating material may be hard wood sawdust, "Flour" sawdust (used at Nelson's Wharf), charcoal packed to a consistency of 11 lbs. per cubic foot, used largely at the Victoria Docks, silicate cotton not too tightly packed, brown paper, Willesden paper, and match boarding. The insulation is best kept 2½ in. to 4 in. clear of the brickwork, and the space thus formed ventilated by air bricks.

Apportionment of the Work.—When the kind of apparatus and engines is decided on they may be the subject of a provision, the building work, as engine beds, boiler setting, &c., being treated as elsewhere described. The motive powe may be either electricity or steam.

HEATING BY HOT AIR OR STEAM.

Heating usually the Work of a Specialist.—The treatment of the heating for a building is nearly always the employment of a specialist for the apparatus, and the general contractor for attendance, cutting away and structural work.

Apportionment of the Work.—The apparatus and its fixing would appear in the specification as a provisional sum, and the work of the contractor in the general specification. It is best to make a separate section of it in all trades.

A domestic water supply is sometimes connected with a few coils which form a part of the flow and return.

Heating Engineer should guarantee a specific Heat.—Part of the

contract of a specialist should be the maintenance of a certain heat when the temperature of the external air is a given number of degrees below freezing.

The simplest hot air apparatuses are Grundy's stove and the Gurney stove.

Grundy's Stove.—Grundy's stove is fixed in a brick chamber below the main floor, to which cold air is admitted from outside and delivered in the building by brick channels and gratings.

Gurney Stove.—Gurney's stove is often fixed in a chamber below the main floor of the building; to this chamber through channels, with gratings fixed near the entrance doors at the end of the building, opposite to the chamber before mentioned, the air is drawn to the stove and delivered from the chamber into the building.

Heating by hot water or steam is, however, more in favour, and is in many respects superior to heating by hot air.

Heating by Steam.—If there is machinery driven by steam the heating may be effected from the boilers.

ELECTRIC LIGHTING.

Work usually done by a Specialist.—As this work is always done by a specialist, no advantage is to be derived from its inclusion in the general contract. As, however, the architect cannot obtain the benefit of competition unless he has a fair general knowledge of the requirements, this section has been included. If the architect does not prepare a specification the electric lighting contractor should furnish a specification and such drawings as will clearly indicate his intentions, and he should guarantee the efficiency of his work.

Apportionment of the Work.—The specialist's work may be confined to the actual electric machinery, accumulators, wires, lamps, casings, &c., and he may either do his own cutting away and making good, or the general contractor may do it under his direction.

The specification must clearly express the intention in this respect.

Electric Power generated on the Premises.—Electric energy for use in a country house must be generated on the premises. The power may be water, applied by an ordinary waterwheel, or a turbine, or a steam, oil, or gas-engine, and a dynamo. A battery

of accumulators will also be necessary. Where gas already exists, a gas-engine is cheapest; if not, a steam-engine must be used.

Public Supply of Electricity.—In towns where a public electric lighting system has been established the whole of the foregoing will be dispensed with, and the work will only involve the wiring, switch boards, casings, lamps, &c. The public supply of electricity may be by *alternating current,* which, on its delivery into the building, is reduced to working pressure by a transformer, supplied by the company at a rental. The meter is also supplied by the company.

The alternative method is by *continuous current,* which is delivered at a working pressure.

In London both of these methods are in use, some districts having one system, some districts the other, and some districts both.

Regulations for the Supply of Electricity.—Several of the fire offices have drawn up regulations for the installation of electric power in buildings, among others "The Phœnix" and "The Sun." A study of these, especially the former, will show the architect many things which he must observe.

The specification writer should also be familiar with the regulations of the London County Council about electric lighting.

All the public supply companies make a reduced charge for electricity used for motive power, heating, or cooking.

Best System of Wiring.—The best and safest system of wiring is known as the multiple circuit, by which mains are carried to distributing boards, thence to smaller distributing boards, from which separate lamp circuits of six or eight lights are taken and governed.

Treatment of Casings.—Casings in the better part of a house may sometimes be constructed to resemble a dado-capping, a picture rail, or a wooden cornice, or the wooden ribs of a geometrical ceiling. In the commoner part of the house they may be exposed, and of the ordinary character. The wood should in any case resemble that used for the fittings adjacent.

What an Electric Lighting Company supplies. — The electric lighting companies issue a list of printed directions to contractors, and the architect should, before writing his specification, read the directions of the company whose supply he proposes to use.

The company supplies the meter at a rental, and lays the supply between their mains and the consumer's premises. Some

companies limit the length to which they will supply their mains free of charge to 30 ft. The company also supplies a cut-out, and a main switch, and it arranges their position in the building. The determination of their position is consequently the first consideration in the inauguration of the scheme of lighting.

Testing the System.—When the contractor has completed his system, including the fixing of the lamps, and has tested it, the company will test it without charge, but if defects render another test necessary, the company will charge 10*s*. for such test.

Stipulate that the contractor shall give all notices and pay all fees, as well as any extra fees which may be charged for testing.

Incidental Requirements.—If old gas fittings are to be removed a clause should appear: "Remove and credit the whole of the gas fittings and pipes throughout the building, and make good all work disturbed."

If the electric lighting contractor does his own cutting away and making good: "The electric lighting contractor shall cut away and make good as required, and supply all necessary attendance."

Taking up carpets and removal of furniture is best done by the employer, as they are thus less likely to sustain damage.

Lighting Power required for Domestic Buildings.—The approximate extent of lighting power required for rooms of various kinds may be assumed as follows:—

Bedrooms ...	1	candle	power	to	each,	6 ft.	of	floor	area.
Dining-rooms ...	,,	,,	,,	,,	,,	4 ft.	,,	,,	,,
Drawing-rooms	,,	,,	,,	,,	,,	3 ft.	,,	,,	,,

The specification describes an installation of 100 lamps of 16 candle power.

Specification for Electric Work.—Sometimes the building owner employs an engineer who prepares drawings and a specification. Such a specification, whether written by a special engineer or the architect, should clearly define which parts of the works should be done by the general contractor and which by the electrical contractor. The clauses affecting the general contractor should appear in the general specification.

The specification for the sub-contract must be preceded by general conditions which may affect the work.

Deposit of Samples by Electric Lighting Contractor.—Some specifications stipulate for the deposit of samples of the various materials and fittings, and in case of those fittings of which it may not be easy to supply samples, drawings to an approved scale.

ROADS.

Road Making seldom an Architect's Work.—The making of roads does not often occur in an architect's work. The communication between the buildings of a great establishment like a barrack or a hospital, the approaches to a house, or the development of a building estate will, however, sometimes involve it.

The paving and sewering of town roads is usually done by the urban authority.

Local Material for Road Making.—Local materials should be used wherever practicable. Of these limestone and chalk are the worst. Either of them may be used for the foundation of a road, but harder material should be used for the covering. A little observation of the district in question will show the popular local material, and preserve the architect from waste of his client's money.

Materials of Macadam.—Macadamized roads are covered with broken granite, syenite or basalt, flints (of which field flints are best), sandstone or limestone.

Paving for Roads.—Paved roads may be covered with granite setts, wood blocks, or asphalte, on a concrete bottom.

Footpaths.—Footpaths by the sides of roads are only used in towns and villages. They may be of York stone, artificial stone, asphalte, tar pavings, gravel, broken stone, or cinders. The ordinary country road has no footpaths.

Curbs. — Curbs may be of either of the various granites, Kentish rag, &c.

Granite Pitching.—Granite pitching is laid in various ways, and of various qualities. The price consequently varies considerably. The following clauses are for good work :—

"The pitching shall be of 3 in. by 5 in. Aberdeen granite setts, laid in regular courses, tightly driven together and grouted with a mixture of pitch, tar, creosote oil, and plaster of Paris well boiled together, and poured into the joints in a boiling state."

"The proportions of the materials for the grout shall be $3\frac{1}{2}$ cwts.

of pitch, 5 gallons of tar, ½ gallon of creosote oil, and 6 lbs. of plaster of Paris thoroughly mixed."

"The pitching shall be so laid and grouted as to be thoroughly water-tight."

STAIRCASES FOR HEAVY TRAFFIC AND ESCAPE STAIRS.

Staircases for Great Traffic.—The hardest stone, when exposed to great traffic, wears quickly away. To resist this wear, various expedients are current. Doulton's (Lambeth) patent imperishable silicon tread may be applied to concrete, stone, brick, or wooden steps, and thus described:—

Steps of Stone and Silicon.—"The staircase to the underground urinals (Fig. 140) shall be York spandril steps, 14 in. by 7 in. extreme, splayed and splay-rebated as sketch, and rubbed when exposed, rebated and grooved for and fitted with Doulton's patent imperishable silicon tread, 5¼ in. wide, with square nosing, and bedded and jointed in Portland cement."

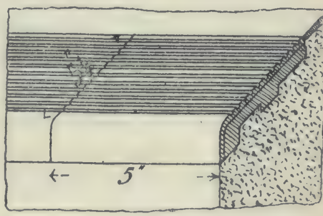


FIG. 140.

"The landings shall be 5 in. York, rubbed on the underside, grooved for and fitted with covering to match that of stairs."

Steps of Concrete and Silicon.—"Construct the staircase from ground to first-floor of cement concrete as described for floors. The landings to be 6 in. concrete covered with Doulton's patent imperishable silicon bedded and jointed in cement."

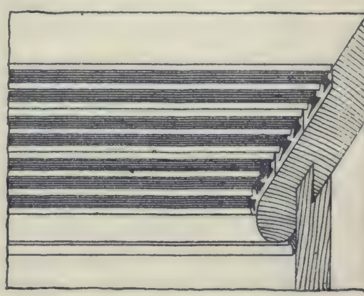


FIG. 141.

"The steps of similar concrete to finish, 10½ in. treads with 7 in. risers of spandril section, and 2 in. thick between soffit and angle formed by tread and riser, measured at right angle with soffit."

"Render the soffit of steps and landing with Portland cement."

Mason's (15, Barbican) patent unwearable non-slipping stair treads, in steel (Fig. 141), are useful for the same purpose, and may be applied in a similar manner.

Staircase of Stone and Steel.—"Construct the staircase to underground urinal of York spandril steps, 14 by 7 in. extreme, splayed and splay-rebated as sketch, cut, rebate in front part of tread, and holes for caulking nuts, and supply Mason's patent unwearable non-slipping stair tread $5\frac{1}{2}$ in. wide, and bed in cement. The applied tread shall stop 3 in. short of each end of the step."

"The landings shall be of 5 in. York, rubbed on the underside, and entirely covered with metal tread to match the steps."

Metallic treads to Stairs.—These treads may also be applied to an ordinary wooden staircase, thus :—

"Supply to the treads of staircase from ground to first floor, the entire length of steps, Mason's patent unwearable non-slipping stair-treads $5\frac{1}{2}$ in. wide, screwed with stout screws with countersunk heads. Cover the landings entirely with metallic covering to match the treads."

"Fill up the space between the back edge of the metallic tread and the wooden riser with kamptulicon of best quality and of equal thickness to that of the metal accurately fitted and glued on with marine glue."

Either Doulton's or Mason's tread may be applied to old and worn treads by sinking them to receive it.

Hawksley's Patent Tread.—The staircases of offices, railway stations, and buildings of a similar character may have Hawksley's patent treads made of small cubes of wood, set in a cast-iron frame. These may be fixed to an ordinary wooden staircase, or may be supported by iron bearers, or they may be substituted for the ordinary wooden treads.

Iron Staircases.—There are several ironfounders who supply these in stock patterns, and they are most conveniently described by reference to their trade lists, thus :—

"Supply and fix for access from ground to first floor the St. Pancras Ironwork Company's (St. Pancras Road, London) No. 603 iron spiral staircase, 4 ft. diameter, and continue balustrade to match around the wellhole."

Iron Escape Stairs.—These (Figs. 142 and 143) are iron external staircases for escape when, as in case of fire, the ordinary way is impassable. They are frequently used for hospitals, and should be specially designed with landings at the level of each floor. The following is an example. They are

generally most conveniently described as a separate section in all trades, and are sometimes a separate contract, as follows :—

ESCAPE STAIRS IN ALL TRADES.

"Build the piers for the columns of hardest blue Staffordshire bricks in cement.

Supply for each column a base, 18 in. by 18 in., finely tooled all around, and bedded in cement.

Supply 14 in. by 4 in. York templates, tooled where exposed to the ends of the rolled joists.

The columns shall be $3\frac{1}{2}$ in. solid cast iron, with moulded caps and bases, and 1 in. cap and base plates ; the caps to be bolted with $\frac{1}{2}$ in. bolts to the girders.

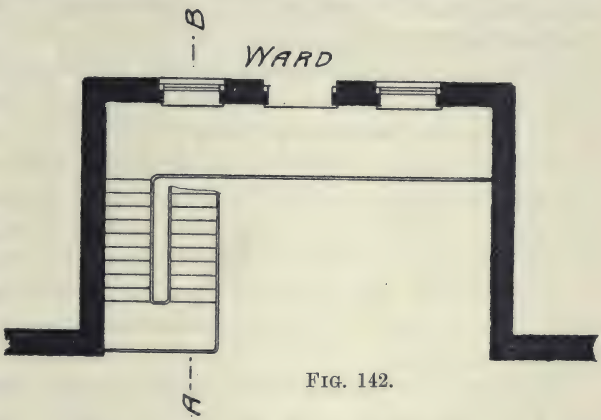


FIG. 142.

The girders and joists shall be of rolled steel.

Construct the first and ground floor landings with 12 in. by 6 in. front girder, weight 44 lbs. per foot run, and 2 in. by 2 in. angle steel as joists, 18 in. apart, notched, cleated, and riveted to the girders, and built into the walls. Construct the half space landing of two $9\frac{1}{2}$ in. by 4 in. joists, weight $20\frac{1}{2}$ lbs. per ft., with 3 in. by 2 in. rolled joists, 18 in. apart, laid on the larger joists and riveted thereto. Cover each landing with $\frac{5}{16}$ths in. wrought-iron chequered plates with planed joints, and screwed with $\frac{5}{16}$ths in. stove bolts, with countersunk heads, to the angle steel joists. The outer strings

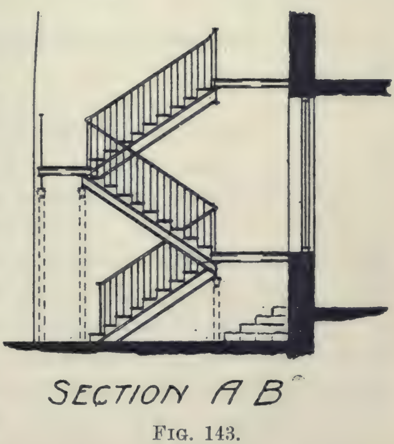


FIG. 143.

shall be $9\frac{1}{2}$ in. by 4 in. joists, weight $20\frac{1}{2}$ lbs., cleated and bolted to the main horizontal joists of the landings.

Forge the ends of the strings at foot of staircase, and bolt each with two 1 in. lewis bolts 9 in. long to a 12 in. by 6 in. tooled York sill the whole width of staircase, laid flush with the floor on cement concrete 12 in. thick.

Supply to receive treads cast-iron ornamental triangular brackets, pierced to design, and each bolted to the iron strings with two $\frac{1}{2}$ in. bolts.

Construct the treads with $\frac{1}{2}$ in. cast iron, perforated to design, with rounded nosing, and each screwed to the brackets with four stove bolts, the heads let in flush.

The balustrades shall be of wrought iron of $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. oval handrail, the ends caulked and built into the walls with easy ramps and curves, and down scrolls at foot of staircase. Three-quarter in. by $\frac{3}{4}$ in. balusters, the ends shouldered and screwed, passed through the plates of landings or treads, and screwed with screw nuts. Put at foot of staircase $1\frac{1}{4}$ in. by $1\frac{1}{4}$ in. chamfered newel.

Supply to the balustrades of each principal landing two 1 in. by 1 in. standards, with curved stay riveted to the standard, and the bracket next described.

Supply under each standard and stay a triangular bracket of $2\frac{1}{2}$ in. by $2\frac{1}{2}$ in. T steel 9 in. projection, and 7 in. high, riveted at back to the web of the front girder of the landing."

CONTRACT.

Endorsement on Specification.—The conditions being attached to the specification, it should be endorsed at the end, "This is the specification referred to in the contract dated June 1st, 1899," and should be signed by both building owner and builder.

Endorsement of Drawings.—Each drawing should be endorsed, "This is one of the drawings referred to in the contract dated June 1st, 1899," and should be signed by both building owner and builder.

What a Contract should comprise.—The contract should describe the position of the building, the names of the contracting parties, an undertaking by the contractor to erect the building for a certain sum to the architect's satisfaction, according to the

drawings, specification, and conditions (and quantities, if they are to form a part of the contract).

Contract should be short.—The shorter the contract, so long as it embodies the intentions of the parties, the less will it be liable to misconstruction. The solicitor's contract often embodies the whole of the conditions. Reference to them serves every purpose.

Conditions may be attached to Contract.—If preferred, the contract and conditions may be combined as in the last set of conditions, published by the Royal Institute of British Architects, page 195.

A simple form of contract is given, page 392.

Direct Contract for a Part of the Work.—A contract for a part of the work, as structural ironwork, terra-cotta, heating, or the like, will be described by a subordinate specification, which will embody certain conditions, and which may be referred to in the same manner as in a "lump sum" contract.

A form of such contract for terra-cotta is given on page 393, which may be taken in conjunction with the specification for the manufacture and delivery of terra-cotta, page 379.

THE RELATIVE VALUE OF VARIOUS ITEMS OF WORK.

Next in importance to a competent knowledge of construction is a proper acquaintance with the relative value of the items described in a specification, and the consequent preservation of a reasonable proportion between their values in a particular building.

A good builder's price-book will show this to some extent, and the collection of trade lists elsewhere recommended will assist the specification writer to the same end.

The student of specifications will derive substantial advantage from the practice of preserving notes of all the prices with which he may have to deal.

Of one of these methods, the common-place book, it is impossible to overrate the importance. The larger number of those men who have become distinguished in any profession have adopted it. By no other means can such a store of professional knowledge be acquired, nor will it in any other way be so readily accessible. The experience of any one will be sufficient to recall the recollection of long and tedious search

(perhaps of days) for information cursorily read and almost forgotten which might have been by those means found in a few minutes. Much depends upon the system adopted. The leading principle is easy and clear reference. There are two kinds: one, the "index rerum," as it has been called, which contains *references* only, to passages of interest. The other, the "common-place book" proper, mainly a collection of the passages themselves. Directions for the management of the "index rerum" are thus given by Dr. John Todd, author of the "Student's Manual": 1. When you meet with any subject of interest, note the subject, the book, the page, and any word distinguishing its qualities. The index should be your constant companion when you read. 2. Make your index according to subjects, as much as possible selecting that word which conveys the best idea of the subject. 3. Put, at the upper left-hand corner of the page, a capital letter as A, B, &c.; in the centre one of the first five vowels, as *a*, *e*, *i*, *o*, *u*. 4. Place the principal word in the margin under the first letter in that word, and the first vowel in it. For America, I turn to capital A and the vowel *e*, because A is the first letter and *e* the first vowel. A book with faint lines is best, and it should be ruled as below :—

A	*a*

A	*e*

B	*a*

B	*e*

Examples of the entries are as follows :—

A	*e*
America.	Supposed to be known in time of Homer. Thomas's "History of Printing," Vol. I. p. 20.
Atheism.	Of France, picture of. Schlegel's Lectures, Vol. II. p. 199.

B	*a*
Bradford.	Governor, Notices of. *American Quarterly Review*, Vol. II. p. 497.
B	*o*
Brougham.	Graphic and powerful description of. Post, Rhetorical Reader, p. 248.

The scale of apportionment of pages recommended by Todd is as follows :—

A 3	J 2	S 6
B 6	K 2	T 4
C 4	L 3	U 3
D 3	M 6	V 3
E 3	N 2	W 6
F 3	O 2	X 2
G 4	P 6	Y 2
H 4	Q 2	Z 2
I 3	R 4	

The foregoing will not be found an infallible guide; various circumstances will arise to modify the proportion—as a peculiar direction of study. A common-place book may be constructed in a precisely similar form, except that instead of a mere reference to subject, volume, and page, we adopt subject, page, volume, extract, or it may be a mixture of both, or it may include newspaper cuttings and small original memoranda of which it may be desired to preserve a record.

The reference word should express the leading idea, and should be selected with judgment. Another method of keeping a common-place book has been recommended by Mr. G. A. Sala, and was the method adopted by him. He says: "Take a book, large or small, according to the size of your handwriting, and take care that at the end of the book there shall be plenty of space for an index; begin at the beginning, and make your entries precisely as they occur to you in unordered sequence. But after each entry place a little circle or oval, or parenthesis, thus—( ), and in a portion of these spaces put consecutive numbers. Here is the model for a page: 'The Prince of Wales wore the robes

Q	*u*
Quantities.	I advise employers not to let the quantities be taken by any one who can be made out to be their agent, nor to recognise them in any way except as after mentioned with reference to a schedule of extras. Sir Edmund Beckett, " A Book on Building," p. 32.
B	*e*
Bedrooms.	Decoration of, remarks on. " House Decoration," R. and A. Garret, p. 30. This might also appear as below.
D	*e*
Decoration.	Bedrooms, remarks on decoration of. " House Decoration," R. and A. Garret, p. 30.

of the Garter at his marriage in St. George's Chapel, Windsor, all the other K.G.'s present wore their robes and collars. Mr. W. P. Frith, R.A., who was to paint a picture of the wedding for the Queen, stood close to the reredos to the right, looking from the organ-loft (1023).' 'Just before the liberation, in 1859, of Lombardy from the domination of Austria, the audiences in the Italian theatres used to give vent to their pent-up patriotism by shouting Viva Verdi; the initiated knew that this meant to signify Viva V. (for Victor), E. (for Emanuel), R. (for Re), D.I. (for D. Italia), (1024).' Now, all you have to do is, immediately you have made your entry, to index it, and if you will only spare the patience and perseverance, to cross-index it. Thus, under the letter W you will write Wales, Prince of, married in robes of the Garter (1023), under G, Garter, Robes of, worn by P.O.W. at his marriage (1023). Under F, W. P. Frith, R.A., present at marriage of P.O.W. (1023). Thus also Verdi, Victor Emanuel, and Italy will be indexed under their respective letters V and I, to be referable to at 1024. Write the figures in the circumscribed spaces in red ink. The corresponding ones in index may be in black." Of common-place books, as compared with his "Index Rerum," Dr. Todd says, alluding to Locke's system: "Neither that nor any other common-place book which I have ever seen will either come into anything like extensive use or be of any essential advantage to the student and man of literary habits: they require too much time and too much labour. Everything

that is saved must be copied out in full, and then noted also in the index. Few have the time, and fewer still the patience, to do this." This is not by any means a general opinion. We recall the somewhat hackneyed but pregnant sentence: "Reading maketh a full man, conference a ready man, writing an exact man." For the third reason, irrespective of the value of the store of knowledge amassed, the common-place book is to be strongly recommended. The foregoing are those for the arrangement of general professional information. For prices there is still one other method—the arrangement of the average price-book in trades. The student should have a book for each trade, and enter every price that comes in his way in its respective book. Every element which has affected the cost of work, all the information obtainable as to the working of particular materials, relative values, weights and measures which are novel, &c.; and in every case date the item and state its derivation, as both source and date are important. The student should also seize upon every opportunity which may offer of observing and making notes of the time and material expended upon certain quantities of work. The most valuable will be those of larger bulk, as from these more reliable results may be deduced for the valuation of smaller quantities. For example: The notes of the production of a thousand yards of concrete will yield a more reasonable average than ten. This practice will, besides enriching his store of information, help the student to foster habits of observation and precision such as would be worth very much more trouble to acquire.

The following are a few points to be observed, the items arranged in the order of their value, the cheapest first.

Excavator.

Digging.—Dig and wheel and deposit on the site.

Dig and cart away.

The distance of removal for the earth dug is sometimes important.

Concrete.—No concrete.

Broken brick from an old building or stone chippings produced in the works instead of ballast.

Burnt clay instead of ballast when the clay is obtained from the trenches and the ballast is distant.

Reduction in the proportion of lime to ballast.

Lime concrete of the ordinary proportions.

Lias lime concrete.

Cement concrete.

Ramming the concrete and depositing it in layers increases the cost.

Drains.—Ordinary stoneware pipes jointed in cement.

Do., do., the joints puddled round with clay.

Do., jointed in cement and laid on a bed of cement concrete.

Do., jointed in cement and enveloped by cement concrete.

Tested stoneware pipes instead of ordinary.

Do., with Stanford joints.

Iron pipes.

Direct connection of wastes or rain-water pipes with drains.

Delivery of every waste or rain-water pipe over a gulley.

Two systems of drainage, one for soil and another for rain water.

Brick sewers.—Ordinary bricks in cement.

Gault bricks in cement.

Blue Staffordshire bricks in cement.

Purpose made ("compass" bricks) gault bricks in cement.

Do., blue Staffordshire in cement.

Inspection pits.—Brickwork in mortar with struck joint inside.

Do., in cement.

Do., in mortar rendered in cement inside.

Do., in cement rendered in cement inside.

Do., in cement lined with salt glazed bricks.

Do., white glazed bricks.

Brown stoneware channels.

White enamelled channels.

Mortar.—Stone lime and burnt clay.

Stone lime and engine ashes.

Stone lime and sand.

Lias lime and either of the foregoing.

Cement and either of the foregoing.

Well burnt clay is sometimes used when sand is only obtainable from a long distance. Clay may often be obtained from the foundations, ashes from a locomotive depôt near at hand.

The use of a mortar mill commonly increases the cost of mortar.

Reduced proportion of lime to sand is a saving.

Reduced proportion of cement to sand is a saving.

Brickwork.—Brickwork of all place bricks in mortar.

Do. one half place bricks one half stocks in mortar.

Brickwork of all stocks in mortar.

Brickwork in cement.

Hollow brick walls with iron ties.

Do. with stoneware bonding bricks.

Do. filled in with asphalte (ties usually omitted).

Blue Staffordshire bricks in cement.

Where brickwork is in large masses concrete walling will effect a considerable saving; in buildings of the ordinary character the saving is small. In many estimates in which the alternative of concrete to brickwork is proposed the builder will offer no saving.

Facings.—Ordinary brickwork finished with a struck joint.

Facing with bricks selected from the building bricks and finished with a struck joint.

Facing with picked stocks.

Do. red or white facing bricks.

Gauged facing.

Pointing.—Joints struck fair as the work proceeds.

Raking out and pointing with a weather joint.

Raking out and tuck pointing.

Raking out, colouring, and tuck pointing.

Raking out the joints and pointing, and the use of coloured mortar for pointing, increases the cost.

Blue Staffordshire facing.

Salt glazed facing.

Best glazed facing.

Arches.—Ordinary bricks in half brick rings.

Facing bricks axed.

Rubbers rubbed and gauged and set in putty.

Damp-proof courses.—Pitch, tar, and sand.

Bituminous felt.

Mineral asphalte.

Slate in cement.

Seyssell asphalte.

Partitions.—Half-brick partitions.

Do., brick nogged.

Pavings, including the rubbish or concrete beneath.

Tar paving on hard dry rubbish.

Granitic cement paving on hard dry rubbish.

Cement paving on concrete.

Stocks flat in sand on hard dry rubbish.

Stocks on edge in sand on hard dry rubbish.
Blue Staffordshire building bricks on concrete.
Blue Staffordshire paving bricks on concrete.
Asphalte on concrete.
Dutch clinkers on concrete.
Adamantine clinkers on concrete.

Tile Pavings, including the concrete beneath.
Staffordshire quarries on concrete.
Encaustic tiles on concrete.
Glazed tiles on concrete.

Stone Pavings.—Yorkshire stone.
Portland stone.
Marble.

Stone Staircases.—York.
Portland.
Marble.

A saving may often be effected by the use of various kinds of artificial stone steps, but this only when the steps are nearly all alike. When there is much variety, as in winders of different size, the work will cost as much or more than stone.

Dressings.—Dependent upon the quantity, and when of stone the degree of hardness and distance from the quarry.
Coloured artificial stone.
Terra-cotta.
Bath stone.
Portland stone.
Dumfries stone.
Mansfield stone.
Granite.

Stone Walling.—Random rubble walling.
Random coursed ditto
Coursed rubble walling in regular courses.

Slating.—The smaller slates are a less price than the larger.
Spaced Countess slating, zinc nails.
Countess slating, 2½ in. lap, zinc nails.
Do, copper nails.
Ton slating in diminishing courses.

Tiling.—All kinds increase in cost as the gauge is lessened.
Local tiles with nibs.
Do., nailed or pinned as well as nibbed.
Broseley tiles.

Ridges.—Tile ridge.
Slate ridge.
Wooden rolls covered with lead.

Carpenter.—The timbers are sometimes placed 14 in. or 15 in. apart instead of 12 in.

The specifying of carpentry as "finished sizes" increases the cost. Stained work involves the use of selected timber, and has the same effect.

Timber.—Swedish.
Common Dantzic.
Best middling Dantzic.
Pitch pine.
Oregon pine.
Crown Memel.
Teak.
Oak, best English.

Deals.—Common deals.
Best Swedish deals.
St. Petersburgh or Onega, best.

Small Roofs.—Rafters only, covered with slating battens.
Rafters and collars, covered with slating battens.
Rafters covered with boarding and felt.

Larger Roofs.—Roof trusses with rafters laid horizontally as purlins and covered with boarding.
Roof trusses, purlins, rafters and boarding.
Do., with slating battens and felt.

Some of the elements of cheapness in roofs are as follows:—Simplicity of plan, uniformity of pitch, avoidance of lead flats or parapets with the gutters consequent thereon, restriction of spans of trusses and purlins, the omission of felt slating battens or tile laths.

When roofs are tiled it is cheaper to use feather-edged boarding than boarding and tile laths.

Floors.—Plates and bridging joists.
Girders, plates, and do.
Girders, plates, bridging joists, ceiling joists.
Either of the foregoing with sound boarding.

In large spans the question of the use of columns or stanchions or the increase of the size of the girders will present itself, and the use of columns will generally be found the cheaper.

Fencing.—Deal sawn weather-boarded fence.

Oak park pale fencing with "cant" rails.

Do., with arris rails.

Iron unclimbable fencing (Bayliss, Jones and Bayliss).

Joiner.—Specifying joinery as "finished sizes" increases its cost. The use of stain instead of paint involves the use of selected deal with consequent expense.

Floors.—Special mouldings are another element of expense. So is the moulding of joinery on solid unless imported rough boarding is used as a floor. Floors are invariably wrought.

1 in. wrought battens.

$1\frac{1}{4}$ in. do.

The foregoing rebated or tongued with wood or iron.

Skirtings.—Square.

Torus.

Moulded.

Doors.—Ledged.

Square framed.

Moulded.

Moulded and raised panels.

Framed and braced.

Increase in the number of panels or the sashing of doors increases the cost.

Doors of hard woods.

Do., veneered.

Frames.—Ordinary frames.

Frames made up in pieces.

Windows.—Sashes and frames.

Casements and frames.

Both sashes and casements are often full of extra labours as expedients to exclude the weather. Very small squares and unusually large bars also add to the expense, and as a rule casements opening inwards are more expensive than those opening outwards.

Partitions.—Matched and ledged.

Square framed.

Moulded.

Moulded on solid.

Jamb Linings.—Plain, with stop nailed on to form rebate.

Single rebated.

Double rebated.

Double or single rebated and square framed in panels.
Ditto, and moulded.

Staircases.—Steps with rounded nosings and close strings.
Do., with moulded nosings and ditto.
Steps with returned nosings and mitred to cut strings.

Balusters.—Square.
Turned.
Square, turned.

The foregoing may be specified in various woods. The relative value, as a general rule, is in the following order :—

Deal.
Pitch pine.
Sequoia.
Honduras mahogany wainscot and teak.
American walnut.
Spanish mahogany.

Internal Surfaces of Walls and Plastering.—Joints struck fair and limewhiting.
Render and set walls.
Render, float, and set walls.
Single lath, plaster, and set ceilings and partitions.
Lath, plaster, float, and set ceilings and partitions.
Lath-and-half to the foregoing.
Fibrous plaster.
Wire lathing to the foregoing.
Robinson's cement.
Portland cement.
Parian or Keene's cement.
Mastic.
Polished Parian or Keene's.

Plumbing.—Zinc for all purposes where lead is commonly used.
Zinc flashings and gutters.
5 lbs. lead flashings and soakers.
6 lbs. lead gutters and flats.

Flashings.—Stepped flashing.
Stepped flashing and soakers.
Stepped flashing and secret gutters.

Copper.—Roof work in copper instead of lead.

Service Pipes.—Iron pipes.
Lead of weights according to the water company's regulations.
Do., weights according to the newest sanitary fashion.

Soil Pipes.—Iron pipes.

Heavy lead pipes.

Lavatories.—Twelve inch white basins and slate tops, and brass *cold* water taps.

14 in. white basins and enamelled slate tops, brass long-spouted lavatory cocks for *hot and cold.*

Oval basins with gold lines, nickel-plated cocks for *hot* and *cold,* and marble tops.

Similar to last, but tip-up basins.

Baths.—Iron or zinc without casing, with brass valves for hot, cold, and waste.

Steel, enamelled outside and inside, with brass valves for hot, cold, and waste, and mahogany casings.

Heavy copper with nickel-plated valves for hot, cold, and waste, and mahogany casings.

As last, but porcelain of the best quality.

Kitchen Sinks.—Cast iron.

Salt glazed.

Porcelain.

Butlers' Sinks.—Wood, with lead linings and lead-covered draining boards, cold water supply only.

Porcelain and lead-covered draining boards, and hot and cold supplies.

Wood, with pewter or copper linings, and pewter-covered draining boards, lead puff pipes, hot and cold supplies, quick waste of copper, and lead overflow.

W.c.'s, Servants'.—Hopper pan and trap, with zinc waste-preventing cistern and deal seat.

Pedestal, cane outside and white inside, and iron waste-preventing cistern and deal seat.

Family W.c.'s.—Wash-down cane and white pedestals with pitch-pine varnished seats, galvanized iron waste-preventing cisterns with chain pulls.

Pedestal wash-down closets, white inside and out, with polished mahogany or teak seats, the trap and pan in one piece. Iron waste-preventer of the noiseless kind, with good valves, brass chain, and porcelain pull.

The pedestals may be ornamented and the waste-preventing cistern cased in various woods.

Smith.—Cast-iron columns and stanchions.

Steel riveted do.

Zinc eaves gutters.
Iron eaves gutters, round.
Iron ditto, ogee.
Iron ditto, moulded.
Zinc rain-water pipes.
Iron, round do. with ears cast on.
Do., square.
Do, do., with loose bands.
Lead rain-water pipes.

Hot Water Supply.—Ordinary iron barrel.
Ordinary steam barrel.
Galvanizing either increases the cost.

Gasfitter.—Composition pipes.
Iron pipes.
Do., galvanized.
Do., painted.

Bellhanger.—Ordinary wired bells.
Electric bells.

Painting.—Plain painting.
Painting in parti-colours.
Painting finished grain and varnish.
Painting in enamelled paint.

Glazing.—15 oz. sheet.
21 oz. sheet.
Rolled plate.
Muranese.
Heavier sheet.
Polished plate.
Lead lights.

Paperhanger.—Paper hung directly on the walls.
Do., with lining paper beneath.
Do., with battens, canvas and lining paper.

DESIGN OF BUILDINGS AS IT AFFECTS COST.

Simplicity of plan, and consequently simplicity of roof, is an element of cheapness. Repetition of similar features also saves expense.

One-storey buildings are always more expensive per foot cube than buildings of two or more storeys if the finishings are similar.

Buildings of similar finish cost more per foot cube when the rooms are small than when they are large.

The price per foot cube of dwelling houses will be increased if the whole of the roof space is fitted as attics.

Buildings in country districts may, commonly, be built most cheaply by using local materials.

Tender by open competition, as a rule, produces a lower tender than the offer of the work to a selection of builders. The latter system generally ensures better work, but not always.

SECTION IX:

TRADE LISTS.

Technical Description in Trade Lists.—The specification writer will find his work easier if he has a complete collection of the current trade lists of the merchants and manufacturers who supply the building trade. Many of them are well illustrated, and their technical descriptions should be adopted.

Trade Lists should be dated.—On each list received should be written the date of its receipt, the trade discount, and the discount for cash.

Arrangement and Indexing of Trade Lists.—The smaller lists (not books) are most conveniently preserved in a guard book, paged, and with a strap around it.

The bound books or thick pamphlets may be marked on the outside with a legible number, and arranged in their numerical order on a shelf.

A separate book is necessary for an index, divided into two sections, one for names, the other for subjects, thus Ashton and Green, Slate Merchants, will appear in the first as:—Ashton and Green, Slate Merchants, 94 shelf; in the second, Slate Merchants, Ashton & Green, 94 shelf. Anderson, Silicate Cotton, 64 book; Silicate Cotton, Anderson, 64 book. Technical description of items is also illustrated by the current price books and the books on Quantity Surveying.

Some of the more useful trade lists are to be found in the following table in the order of trades. Only those are mentioned which are illustrated. Laxton's & Lockwood's price books will furnish many other names of manufacturers of building appliances, but a large proportion of them are not illustrated.

Drain Pipes, Traps, and Sanitary Apparatus.—Broad & Co., 2, South Wharf, Paddington.

Doulton & Co., Lambeth.

Winser & Co., Buckingham Palace Road, London.

Ironwork for Roads and Sewers.—Waller, Park Street, Southwark.

Manhole Covers.—Bolding & Sons, Davies Street, London.

Winser & Co., Buckingham Palace Road, London.

Bricks, Plain and Moulded.—James Brown, Braintree. Also moulded bricks, ornamental panels, chimney pots.

Cliff & Sons, Baltic Wharf, Waterloo Bridge, S.E., also porcelain baths, sinks, white and coloured glazed bricks, Hall's tiles.

Collier & Co., Reading. Also ornamental panels, roofing tiles, tile finials, &c.

Cooper & Co., Maidenhead. Ditto.

Doulton & Co., Lambeth. Also Blue Staffordshire bricks of various kinds, and fire bricks.

Edwards, Ruabon. Also ornamental panels, roofing tiles, tile finials, &c.

Hamblet, West Bromwich. Blue Staffordshire bricks of various kinds, and fire bricks.

Lawrence, Bracknell, Berks.

Wall and Floor Tiles.—Craven Dunhill, 37, Maddox Street, Regent Street, W. Also hearths, tile skirtings, cappings, angles.

Maw & Co., Jackfield, Shropshire. Ditto.

Minton, Walbrook, Mansion House, E.C. Ditto.

Terra-Cotta.—Doulton & Co., Lambeth.

Edwards, Ruabon.

Faïence.—Burmantofts, 16, Charterhouse Street, London.

Doulton & Co., Lambeth.

Asphalt.—Claridge's Patent Asphalt Co., 21, Surrey Street, Victoria Embankment, E.C.

Seyssell and Metallic Asphalt Lava Co., 42, Poultry, E.C.

Wood Block Floors, in various kinds of wood.—Duffy, Gainsborough Road, Victoria Park, E.

Goddard & Son, Farnham.

Gregory, Clapham Junction.

Parquetry for walls or floors.—Ebner, 150, Old Street, E.C.

Howard & Sons, 27, Berners Street, W.

Turned Wooden Balusters and Newels.—Carter & Aynsley, 54, Bishopsgate Without, E.C.

Architraves and Mouldings.—Clark, Holland, McConnell & Co., 43 & 44, Holborn Viaduct. Also door and window frames, hand-rails, trellis.

Elliott, Newbury, Berks.

Sandell, 101, Waterloo Road, S.E.

Church and School Fittings.—Cox & Son, Tavistock Street, Covent Garden.

Hammer & Co., 370, Strand, W.

Conservatories.—Messenger, Loughborough.

Fawkes, Chelmsford.

Reversible Windows.—Miller's Patent. The Reversible Window Co., Hart Street, Bloomsbury.

National Accident Prevention Window Co., 159, Victoria Street, Westminster.

Ironmongery.—Adams, R., 67, Newington Causeway, S.E.

Gibbons, 9, Southampton Row, W.C.

Hart, Son & Peard, 88, Drury Lane, W.C.

Pfeil Stedall, Broad Street, Bloomsbury, W.C.

Pryke & Palmer, 48, Upper Thames Street, E.C.

Tonks & Sons, Moseley Street, Birmingham.

Locks and Safes.—Chubb & Co., 128, Queen Victoria Street, E.C.

Hill, J., 100A, Queen Victoria Street.

Hobbs, Hart & Co., 76, Cheapside.

Tucker & Reeves, 110, Cannon Street, E.C.

Revolving Shutters of Wood and Steel.—Clark, Bunnett & Co., Rathbone Place, W. Also stall board plates, metal cased sash bars.

Francis & Co., 64, Gray's Inn Road, W.C. Ditto.

Structural Iron and Steel.—Dorman & Long, Middlesboro'.

Dawnay, London Bridge House, London.

Lindsay, Neal & Co., North Side, Paddington Basin.

Moreland & Son, 3, Old Street, E.C.

Lifts: Hand, Electric, and Hydraulic.—Archibald Smith & Stevens, Queen's Road, Battersea, S.W.

Waygood, Falmouth Road, Great Dover Street, S.E.

Casement Gear.—Elsley, Great Portland Street, W.

Gibbons, Wolverhampton, and 9, Southampton Row, W.C.

Leggott, 226, High Holborn, W.C.

Ornamental Ironwork.—Macfarlane & Co., Glasgow. Also eaves gutters, rain-water pipes, iron sanitary apparatus.

Stevens Bros., 4, Upper Thames Street, E.C.

Fire Mains, Fire Engines, &c.—Beck & Co., 130, Great Suffolk Street. Southwark, S.E.

Merryweather & Sons, Greenwich Road, S.E.

Shand, Mason & Co., Upper Ground Street, S.E.

Cast-iron Gas and Water Pipes.—Bailey, Pegg & Co., Bankside, S.E.

Wrought-iron Gas and Water Pipes.—Russell & Sons, 108, Southwark Street, S.E.

Gas Fittings and Gas Fitters' Requisites.—Evered & Co., Drury Lane. Also electric fitters' fittings.

Hulett, High Holborn. Ditto.

Vaughan & Brown, Kirby Street, E.C. Ditto.

Zinc and Galvanized Iron Cisterns, Dust Bins, Felt.—Braby, 364, Euston Road, N.W.

Croggon & Co., 16, Upper Thames Street, E.C.

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FARROW, F. R. Specifications for Building Works, and How to Write Them. 8vo. 1898.

GWILT, J. An Encyclopædia of Architecture. New edition. 1888.

LEANING, J. Specifications for the Use of Surveyors, Architects, Engineers, and Builders. 8vo. 1894.

MACEY, F. Specifications in Detail. 8vo. 1898.

PEWTNER, W. Comprehensive Specifier; a Guide to Practical Specification. 8vo. 1870.

ROGERS, F. Specifications for Practical Architecture upon the Basis of the Work of Bartholomew. 8vo. 1893.

REID, J. Young Surveyor's Preceptor. 2nd edition. 4to. 1859.

RYDE, E. Text-book for the Constant Use and Reference of Architects, &c. 8vo. 1854.

WIGHTWICK, G. Hints to Young Architects. 2nd edition. 8vo. 1860. New Edition, by G. H. Guillaume. 12mo. 1880.

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Constructional Iron and Steel Work, Stresses, &c.

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Notes on Building Construction. Vol. IV.—Calculations for Building Structures. 1899. (15*s*.) 12*s*.

Roofs and Floors.

Tarn, E. W. Roofs of Wood and Iron. 1893. 1*s*. 6*d*.

Walmsley, A. T. Examples of Iron Roofs. Folio. (£3 3*s*.) £2 10*s*.

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Fireproof Construction.

Freitag, J. K. The Fireproofing of Steel Buildings. New York. 1899. 10*s*. 6*d*. net.

Potter, T. Concrete and its Use in Building. 1894. (7*s*. 6*d*.) 6*s*.

See also the collected reports of the British Fire Prevention Committee, Vols. I.—III., and Text-books on Building Construction.

Concrete, Limes, and Cements.

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Potter, T. Concrete and its Use in Building. 1894. (7*s*. 6*d*.) 6*s*.

Reid, H. The Manufacture of Portland Cement. 1877. 12*s*. 6*d*.

Sutcliffe, G. L. Concrete, its Nature and Uses. (7*s*. 6*d*.) 6*s*.

Bricks and Brickwork.

Davis, C. T. The Manufacture of Bricks, Tiles, and Terra-cotta. Philadelphia. 1895. (25*s*.) 21*s*.

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Hammond, W. Practical Bricklaying. 1899. 1*s*. 6*d*.

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Masonry, Building Stones, &c.

Baker, I. D. A Treatise on Masonry Construction. 1897. 21*s*. net.

Burn, R. S. Guide to Masonry, Bricklaying, and Plastering. 4to. N. D. 18*s*. 6*d*.

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Timber.

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Stevenson, W. Wood, its Use as a Constructive Material. 1894. (4*s.* 6*d.*) 3*s.* 9*d.*

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